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## Editorial

The 20<sup>th</sup> volume of the News Bulletin of Nepal Geological Society (NGS) is in your hands. In the last two decades the Society has come a long way in the publication fronts. We have maintained a good pace and quality in the publication of Society's Journal as well as the News Bulletin. The journal has already received its ISSN Number and its abstracts are indexed in international publications. It has become a premier publication in the field of Himalayan geoscience. We are particularly proud that the journal is subscribed by reputed international libraries, universities as well as individuals and NGS members. However, we have to work hard to increase the number of subscriptions both at international and national levels to make the journal self-sustainable.

The News Bulletin is also one of the important publications of our Society. It not only provides our members the information on activities of NGS, but also carries many interesting articles as well as abstracts and papers presented in workshops and seminars that the society organizes within the preceding year. From this issue, the editorial board has decided to publish the full articles in a format similar to the Journal of Nepal Geological Society and will also provide 25 copies of reprints to the authors. We are confident that this will encourage our members and others to write articles for the Bulletin on various topical and interesting subjects, as our journal will not be able to include articles that do not strictly fulfill the requirements of a scientific journal.

The Editorial Board takes this opportunity to thank all the authors for contributing their papers to the Bulletin. We are also thankful to all the members of NGS for their support in all aspects to bring out the publications of our Society. We certainly do need your continuous support and suggestions to improve our publications in the days to come.

-Editors

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3. Journal of Nepal Geological Society Vol. 26, June 2002
4. Journal of Nepal Geological Society Vol. 25 (Special Issue), Dec. 2001
5. Journal of Nepal Geological Society Vol. 24 (Special Issue), 2001 (Abstract Vol. of Third Nepal Geological Congress 2001)
6. Journal of Nepal Geological Society Vol. 23, 2001
7. Journal of Nepal Geological Society Vol. 22, (Special Issue) Dec. 2000 (Proceedings of International Symposium on Engineering Geology, Hydrogeology and Natural Disasters with emphasis on Asia Sept. 28 - 30, 1999, Kathmandu, Nepal)
8. Journal of Nepal Geological Society Vol. 21, 2000
9. Journal of Nepal Geological Society Vol.20, (Special Issue) 1999 (Abstract Volume of Symposium Sept.1999)
10. Journal of Nepal Geological Society Vol.19, 1999
11. Journal of Nepal Geological Society Vol.18, (Special Issue) 1998 (Proceedings of Second Nepal Geological Congress, 1995)
12. Journal of Nepal Geological Society Vol.17, 1997
13. Journal of Nepal Geological Society Vol.16 (Special Issue) 1997 (Abstract Volume of Second Nepal Geological Society)
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17. Journal of Nepal Geological Society Vol.12 (Special Issue), 1995 (Abstract Volume of First Nepal Geological Congress 1995)
18. Journal of Nepal Geological Society Vol.11 (Special Issue), 1995  
(Proceedings of 9<sup>th</sup> Himalaya - Karakoram - Tibet Workshop, 1994)
19. Journal of Nepal Geological Society Vol.10, (Special Issue), 1994  
(Abstract of 9<sup>th</sup> Himalaya - Karakoram - Tibet Workshop, 1994)
20. Journal of Nepal Geological Society Vol.9, 1993 (50% discount Price)
21. Journal of Nepal Geological Society Vol.8, 1992 (")
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23. Journal of Nepal Geological Society Vol.7 (Special Issue), 1991 (")
24. Journal of Nepal Geological Society Vol.6, 1989 (")
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## ● NGS NEWS

**T**he 23rd Annual General Body Meeting of Nepal Geological Society (NGS) was held on 29 August 2002 (13 Bhadra 2059) in the auditorium of Department of Mines and Geology, Lainchaur, Kathmandu. The meeting was conducted under the Chairmanship of Mr. P.S. Tater, President, Nepal Geological Society. The meeting was attended by most of the members and discussions on various topics/ issues were held in cordial atmosphere.

The general body meeting was proceeded with the welcome speech of Mr. P.S. Tater, President, NGS. It was followed by the presentation of annual report by Mr. Rajendra P. Khanal, General Secretary. Mr. Khanal mainly focused on the activities carried out by the society in the last one year period and about the future programs of NGS. After that Dr. T.N. Bhattarai, Treasurer of the society presented the Annual Financial Status Report of 2058/059. It was followed by discussion on various topics. There was active participation of the members in the discussion on various issues raised by the members. Some important decisions were made in the meeting.

**N**epal Geological Society in collaboration with Department of Mines and Geology (DMG) organized the one-day Workshop on *Role of Geoscience in Mineral Resources Development and Promotion of Mineral Based Industries in Nepal*. It was attended by more than 200 participants/ representatives from different government and non-government organizations, institutions, mineral industries, mines and the persons interested in mineral resources and mining industries in Nepal. The Workshop was inaugurated by Hon. Dr. Shankar Sharma, Member, National Planning Commission and chaired by Mr. Ram Krishna Panta, Acting Secretary, Ministry of Industry, Commerce and Supplies, HMG Nepal. The Inaugural session was followed by two Technical Sessions during which 5 working papers were presented by the professionals from the Department of Mines and Geology, Tribhuvan University and representatives of mineral industries and mines. Interaction and discussion on various topics related to mineral based industries, operation of mines and existing

rule and regulations was held in cordial atmosphere. After interaction and discussions some recommendations were made by the participants, which was later submitted to the concern government organizations for prompt early action.

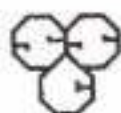
**N**epal Geological Society also successfully organized the one-day Seminar cum Workshop on *Main Central Thrust (MCT)* on 7<sup>th</sup> March, 2003 in Kathmandu. It was attended by more than 150 Geoscientists from Nepal and abroad. Six technical papers were presented at the workshop. Discussions were held among individuals and the working groups. After the discussion it was decided to form a working committee on MCT. The Seminar was inaugurated by Hon. Dr. Yuba Raj Khatriwada, Member, National Planning Commission, Nepal and Chaired by Mr. N.R. Sthapit, Director General, Department of Mines and Geology.

**A**s in the past NGS in cooperation with HMG/ Ministry of Home Affairs, UNDP and NSET-Nepal observed *International Strategy for Disaster Reduction (ISDR) - Day* by organizing one-day National Meeting cum Workshop on 9<sup>th</sup> October 2002 in the International Convention Hall, Kathmandu. More than 200 participants from different national and international organizations took part in the meeting cum seminar. Ten working papers were presented in the Workshop.

**I**n the year 2002/2003 the Nepal Geological Society organized two Geo-scientific talk programs on *Run out Prediction for Large Landslides* by Prof. Oldrich Hunger, University of British Columbia Vancouver, Canada and on *Himalayan Nepal Tibet Broadband Seismic Experiment (HIMNT): Deployment and Initial Results* by Dr. Anne Sheehan, Associate Professor, University of Colorado, USA on 25<sup>th</sup> October 2002 in the auditorium of DMG.

**A**s in the past the Nepal Geological Society is being represented in various meetings, workshops, seminars etc. organized by different government and non-government organizations.





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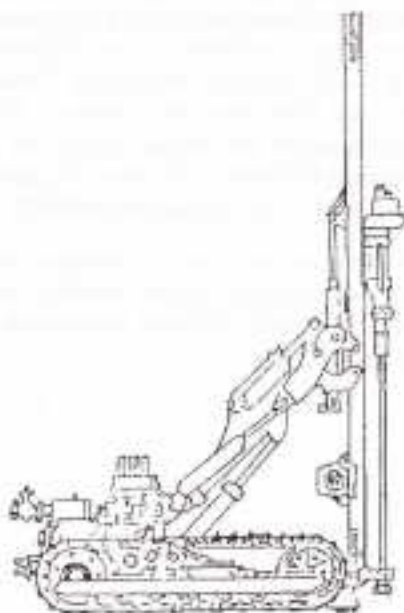
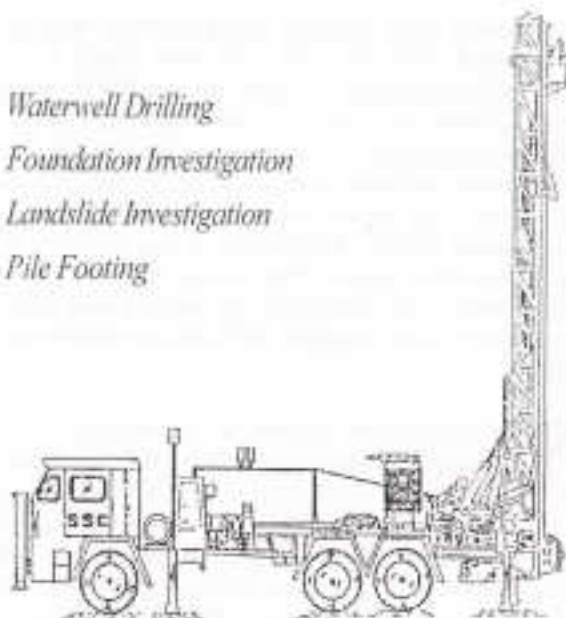
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## 23<sup>TH</sup> GENERAL BODY MEETING OF NEPAL GEOLOGICAL SOCIETY

नेपाल भौगर्भिक समाजको तेइसौं साधारण सभा गत भाद्र १३ गते २०५९ (तदनुसार २९ अगष्ट २००२) का दिन समाजका अध्यक्ष श्री प्रताप सिंह तातेडलेको अध्यक्षतामा काठमाडौं, लैनचौर स्थित खानी तथा भूगर्भ विभागको सभाकक्षमा सु-सम्पन्न भएको थियो। उक्त अवसरमा सर्वप्रथम समाजका अध्यक्ष श्री तातेडले सम्पूर्ण सहभागी सदस्यहरूलाई अभिवादन गर्नु हुँदै स्वागत भाषण प्रस्तुत गर्नु भएको थियो। उक्त अवसरमा निजले नेपाल भौगर्भिक समाजले गत एक वर्षमा गरेका मुख्य मुख्य कार्यक्रमहरू र अब आउदा दिनहरूमा संचालन गरिने कार्यक्रमहरूबारे बोधोपय प्रकाश पार्दै आफ्नो मनस्थिति व्यक्त गर्नु भएको थियो। तत्पश्चात् यस समाजका महासचिव श्री राजेन्द्र प्रसाद खनालले समाजको वार्षिक प्रतिवेदन प्रस्तुत गर्नु भयो। उक्त अवसरमा विगतमा नेपाल भौगर्भिक समाजले संचालन गरेका तथा भविष्यमा संचालन गरिने कार्यक्रमहरूको विस्तृत विवरण दिनुका साथै आउँदो 9th October

2002th ISDR-Day र निकट भविष्यमा आयोजना गरिने Workshop on "Role of Geoscience in Mineral Resources Development and Promotion of Mineral Based Industries in Nepal तथा Main Central Thrust (MCT) कार्यशाला योतिष्ठ सफल पार्न सम्पूर्ण सदस्य साथीहरूसँग सहयोग माग्नुका साथै सन् २००४ मा आयोजना गरिने 4th Nepal Geological Congress बारे राय माग्नु भयो। सोही समयमा उहाँले हालसम्म नेपाल भौगर्भिक समाजको सदस्य संख्या ५९६ र एसोसिएट सदस्य संख्या २८ गरि जम्मा ५४४ भएको कुरा सबैलाई जानकारी गराउनु भएको थियो। यस पछि कार्यक्रमलाई जगाडी बढाउने क्रममा उक्त समाजका कोषाध्यक्ष डा. श्री तारा निधि भट्टराईले समाजको आ. व. २०५८/०५९को आय व्यय विवरण प्रस्तुत गर्नुका साथै लेखा परिक्षणको विवरण समेत प्रस्तुत गर्नु भएको थियो।

### Welcome Speech By Mr. P.S. Tater, President, NGS on the occasion of 23<sup>rd</sup> Annual General Body Meeting

नेपाल भौगर्भिक समाजको तेइसौं वार्षिक साधारण सभामा समाजका अध्यक्ष श्री प्रताप सिंह तातेडले दिनु भएको स्वागत भाषण

सम्मानित सदस्यहरू,  
भूतपूर्व अध्यक्षज्यूहरू,  
समाजका आदरणीय सदस्यज्यूहरू तथा मान्यजनहरू,

सर्वप्रथम म यस नेपाल भौगर्भिक समाजले आयोजना गरेको आजको २३औं साधारण सभामा उपस्थित समाजका सम्पूर्ण आदरणीय सदस्यज्यूहरूलाई नेपाल भौगर्भिक समाज तथा म आफ्नो तर्फबाट हार्दिक अभिवादन गर्दै स्वागत गर्दछु।

आदरणीय सदस्यज्यूहरू, यस का.का.स. ले आफ्नो कार्यकालको प्रथम एक वर्ष अर्थात् पूरा गरिसकेको छ। गत एक वर्षको अवधिमा हामिले सम्पन्न गरेको केहि कार्यक्रमहरू तथा निकट भविष्यमा सम्पन्न गर्ने लक्ष्य राखेर कार्यक्रमहरू बारेको विस्तृत प्रतिवेदन यस समाजका

महासचिव श्री राजेन्द्र प्रसाद खनालबाट र वार्षिक प्रतिवेदन कोषाध्यक्ष डा. श्री तारा निधि भट्टराईबाट प्रस्तुत हुने छ। तत्पश्चात् एजेण्डा अनुसार विभिन्न विषयमा छलफल गरिने कार्यक्रम रहेको छ।

सदाशै यी कार्यकारिणी समितिले समाजका आवरणीय सदस्यज्यूहरूबाट यस समाजको उन्नति तथा प्रगतिको लागि विगतमा जस्तै महत्वपूर्ण सुझाव एवं सरसल्लाहको अपेक्षा राख्दछु।

अब म आफ्नो छोटो भन्तव्य सहि टुट्याउँदै आज यस सभाको लागि तय गरीएको एजेण्डा अनुसार विषय प्रवेशको लागि अन्य साथीहरूलाई आमन्त्रित गर्दछु।

धन्यवाद !!!

## DO YOU KNOW ?

- Earthquake is one of the major destroyers of lives and properties.
- More than 15,25,000 people have died in this century due to fatal earthquakes.
- With more than 11,570 deaths, Nepal ranks 15th in earthquake-related casualties.
- More than 75% of casualties throughout the world are attributed to building failure.
- In Nepal, more than 95% of earthquake-related deaths are due to collapse/damage of buildings that have been designed and constructed without seismic safety.

## DO YOU ALSO KNOW ?

- In Nepal, in an average, major earthquakes have been occurring every 100 years and medium earthquakes every 50 years.
- The great earthquake of 1934 (1990 BS) destroyed/damaged more than 207,200 buildings in Nepal and killed 8,519 persons.
- A building designed and constructed incorporating seismic safety measures saves lives and properties during an earthquake.
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## **Annual Report by Mr. Rajendra Prasad Khanal, General Secretary, NGS**

Mr. Chairman  
Former Presidents of the Society  
Respected Members of the Society  
Ladies and Gentlemen,

It is indeed an honor for me on behalf of the Executive Committee of Nepal Geological Society, and myself to welcome you all to this 23<sup>rd</sup> General Body Meeting of the Society. It has already been one year since we took the responsibility of the office of the Society. During this period we have been keeping our efforts to the extent possible to enhance the scientific activities of the Society and fulfill its objectives.

The Executive Committee of the Society has worked to the extent possible in running the activities of the Society as smoothly as possible. In this context, I would like to inform you that in total the Executive Committee met 14 times and made various decisions. The 11<sup>th</sup> executive committee has formed different Sub-committees: Scientific Subcommittee, Rules and Regulation Sub-Committee; Professional promotion subcommittee, Financial Subcommittee, International Relation subcommittee, Socio-culture subcommittee, National Regional representative, Database subcommittee as well as Advisory Board, Editorial Board, Stratigraphic commission of NGS and NGS-ISDR Council. Most of these sub-committees are actively supporting various activities of the Society.

We organized a joint meeting of Executive committee with former presidents of the society, present and past chairmen, coordinators of various board, council and commission and sub-committees of the society with a view to identify the future activities of the Society.

Dear Respected members,

Now I would like to inform you about some of the major tasks completed during the last one year and then to inform about the planned activities to be undertaken in the coming year.

### **Seminar/ Workshop**

I feel proud to inform you that the Society organized the Third Nepal Geological Congress from September 26-28, 2001 in Kathmandu. The congress mainly focused on various aspects of Regional geology and tectonics of the Nepal Himalayas and its surroundings, Environmental Geology, Natural Disasters, Economic Geology, Hydrogeology, Engineering Geology and Oil and natural gas in General. The Seminar was attended by more than 300 participants from eleven countries e.g. Bangladesh, Denmark, France, India, Japan, Russia, Sri Lanka, Switzerland, United Kingdom and United States of America. It was also good opportunity for geoscientists for sharing of recent knowledge and

experiences as well as dissemination of findings of geological researchers among ourselves. We are of firm opinion that it has contributed to a certain degree in the fulfillment of the objectives of the Society and such kind of activity of the Society shall be continued in future also.

We know that minerals are valuable resources for the development of a country. They constitute important raw materials for mineral Industries as well as basic needs. Nepal possess commercially viable nonmetallic mineral resources like limestone, dolomite, marble, magnesite, talc etc. The potential for finding economic gold, gemstones and petroleum resources is high in the country but exploration for those minerals and fuels has yet to be carried out in detail. A huge potentiality of the construction materials does exist in the country. Till now, there is no proper utilization of all easily available mineral resources of the country. To identify the problems in mineral resources development and to give the recommendation for concerning authority on promotion of mineral based industries, the society recently organized one day workshop in collaboration with Department of Mines and Geology on "Role of Geoscience in Mineral Resources Development and promotion of Mineral based Industries in Nepal" on 15 August 2002. Altogether five working papers (1) Geoscience Education and Professional Manpower Development in Nepal, (2) Investment opportunities in Mineral Sector in Nepal, (3) Mines and Mineral Industries and their contribution in National Economy, (4) Problems and Issues in operation of Mines and Mineral Based Industries in Nepal and (5) Present Status and Issues in Mineral Exploration, Mining and operation of Small Scale Mineral Industries in Nepal were presented in the workshop. The workshop was attended by the representatives of different Ministries/ Departments of His Majesty's Government of Nepal, Nepal Electricity Authority, Tribhuvan University, District Development Committees, Municipalities, Mineral Industries, Representatives of different professional organization, member of the Society and other geoscientists. The fruitful outcome and the recommendation of the Workshop are submitted to the National Planning Commission, Ministry of Industry, Commerce and Supplies, Ministry of Forestry, Ministry of Local Development and Ministry of Science and Technology, Tribhuvan University, Industries and all District Development Committees for necessary action. It will be beneficial to show the significant role of geoscience to the national economy.

Nepal Geological Society collaborated with the Department of Mines and Geology, UNESCO and USGS to organize a 4-day International Workshop on Seismic Analysis in South Asia Region from 9-12 Sept, 2000. It was also a good opportunity for the Society to share the knowledge among all participants and with all organizing Institutions.

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The 11<sup>th</sup> Executive also formed the "NPC Tenth Plan Recommendation Committee" and the recommendation was presented in the SSAFE Seminar and it was submitted to the National Planning Commission.

Respected Members, I am pleased to inform you that the Society is going to organize one-day workshop on "Main Central Thrust (MCT) in the Nepal Himalaya: Issues and Problems" on 10<sup>th</sup> January, 2003 ( 26 Poush, 2059) in Kathmandu and Geological Excursion on 11-12 January 2003 (27-28, Poush 2059). The purpose of the workshop is to discuss on various issues and problems relating to MCT and to identify the common grounds in the advancements made so far, particularly in defining, characterizing, identifying, and delineating the MCT and its structural and Tectonics Models. Nepal Geological Society strongly believes that this kind of endeavor will help our geoscientists in developing a proper focus in the coming days, while working on the MCT problem in particular and the Himalayan Geology in General.

We are highly encouraged from the Workshop of 15<sup>th</sup> August 2002. We are interested to conduct similar workshops on the role of geosciences on hydropower development and Groundwater Exploitation and Irrigation as well as other infrastructure development in the country.

Respected members, as far as organization of an international symposium by the Society is concerned, the executive committee has sent different request letter to the Secretary General of International Association for Engineering Geology and the Environment (IAEG) for the organization of international symposium in 2005. We request all of you, for the new membership of IAEG and for old Members to renew their membership. I would like to inform you all that most of the members of the Executive Committee have decided recently to apply for the new membership of the IAEG.

#### Observing ISDR- DAY

The United Nations General Assembly in 1989 had declared the decade 1990-2000 as the International Decade for Natural Disaster Reduction and the 2<sup>nd</sup> Wednesday of October as the International Day for Natural Disaster Reduction (IDNDR-Day). The Society had observed the IDNDR-Day, since 1991 by organizing meetings and seminars. This Programme had received a national focus and many governmental and non-governmental organizations had been involved. After the completion of the IDNDR decade, the United Nations has declared to observe the International Strategy for Disaster reduction. On this regards, this ISDR-day was observed by the Society on second Wednesday of October 2002, conducting a seminar in close cooperation with Department of Narcotics Control and Disaster Management, Ministry of Home Affairs, His Majesty's Government of Nepal; Disaster Mitigation Support Programme/ Department of Water Induced Disaster Prevention; United Nations Development Programme (UNDP)/ Nepal, all relevant consulting firms, NGOs, INGOs

and professional organizations as well as members of the municipalities were actively involved in the seminar.

#### Talk Programme

In this year 2002/2003, altogether 2 Scientific Talk Programmes were organized by Nepal Geological Society. The first one on "Run out prediction for large landslides" by Prof. Oldrich Hunger, from University of British Columbia, Vancouver, Canada and the second one on "Himalayan Nepal Tibet Broadband Seismic experiment (HIMNET) deployment and initial results" by Dr. Anne Sheehan, Associate Professor, University of Colorado, USA, was organised on 25<sup>th</sup> October 2002 in the auditorium of DMG, Kathmandu.

#### Decoration and Awards

On the auspicious occasion of 56th birthday, His Majesty's the King Gyanendra Bir Bikram Shah Dev decorated two of NGS members Mr. N.R. Sthapit, Member of the Advisory Board of the Society and Director General of Department of Mines and Geology and Mr. B.D. Shrestha, Member of the Professional Promotion Committee of the Society and Senior Geologist of Department of Soil Conservation with Gorkha Dakshin Bahu 3<sup>rd</sup> and 4<sup>th</sup> respectively for their contributions in the field of geoscience and the departmental activities of the His Majesty's Government of Nepal. His Majesty's the King Gyanendra Bir Bikram Shah Dev also awarded two of NGS members Mr. R.K. Aryal and Prof. B.N. Upreti, Former Presidents of the Society with Birendra Aishwarya Sewa Padak-2058 for their devotion and efforts in organizing the International Symposium successfully through the Nepal Geological Society.

#### Publication of Journals and Bulletins

As far as the publications are concerned the Journal and News Bulletin of the Nepal Geological Society are published regularly. The Journal of NGS has gained good reputation not only in our region but also in the geoscientific community of the world over. Various national and international libraries and individuals have subscribed it. The 11<sup>th</sup> Executive Committee gives a high priority for the publication of the Journal of the Society. We have already published the Journal of NGS vol.24, abstract volume of third Nepal Geological Congress; Journal of NGS vol.25, Proceeding of the Workshop on the Himalayan Uplift and Paleoclimatic Changes in Central Nepal Nov. 10, 2000 and Journal of NGS vol. 26 will come very soon in our hand. Proceeding of the Third Nepal Geological Congress is in final stage of editing and it will be published very soon. News Bulletin of the Nepal Geological Society vol. 19 has been published. It is already being distributed free of cost to our respected members and concerning organizations and consulting firms.

We request all our members to buy the Journals and help towards making the publication sustainable. Regarding the Subscription of the Journal of the Society now we have only few subscribing members. I would like to request to all our respected members to subscribe the Journal of Nepal



**25<sup>th</sup>**  
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Geological Society by depositing an advance of Rs. 200 to 500 for members of the SARRC countries and US \$50-100 for other members. This will help us to circulate the Journal to all members in time and Society will benefit from the subscription deposit.

The subscribers will promptly receive the Journal at their address along with the statement account. The Journal will be sent as long as the deposit covers the cost. I request to all our old subscribers also, to renew their subscription.

Respected Members, Nepal Geological Society has recently received the ISSN number for the Journal of Nepal Geological Society. The number is ISSN 0259-1316.

#### **Honours and Scholarship**

As we know that the 21<sup>st</sup> General Body Meeting of the Society had decided to honor two distinguished geoscientists and members of the Society Dr. Patrick Le Fort (LM-92) and Prof. K.S. Valdiya by the Honorary Membership of the Nepal Geological Society. We are inviting Dr. Le Fort and Prof. Valdiya at the forthcoming workshop on Main Central Thrust (MCT) in the Nepal Himalaya: Issues and Problems which is going to be held on 10<sup>th</sup> January, 2003. We plan to honor on this occasion.

Similarly, the 22<sup>nd</sup> General Body Meeting of the Society had decided to award a Gold medal and Life Membership of the Society every year, a student who holds topmost position in M.Sc. Geology from Tribhuvan University. The Executive Committee had already informed to the concerning institution, students and associate members for the medal and Life Membership of the Society for the year 2002.

#### **Members of the Society**

We are happy to announce that the Society has gained a considerable strength in its membership. At present the Society has 516 full members and 28 associate members.

Respected Members, the 11<sup>th</sup> Executive Committee has agreed upon to provide the Institutional Membership of the Society for the relevant national and international organization. We would like to get the recommendation from the General Body Meeting.

#### **Land and Building of the Society**

The 22<sup>nd</sup> General Body Meeting of the Society had decided to allocate a sum of NRs. 15,00,000.00 (Fifteen Lakhs) to establish a fund as "Land and Building Fund", for acquiring Land/ Building in the name of Nepal Geological Society. The 11<sup>th</sup> executive committee published advertisement four times in Kantipur Daily for this purpose. But, no suitable offer was obtained. At the same time, we are in constant touch with several landowners through the subcommittee and trying to negotiate a suitable deal.

#### **Participation and Representation of NGS at Various Activities**

The participation of the Nepal Geological Society is being continued in various workshops, seminars and meetings organized by the Government as well as nongovernmental organizations in Nepal. Such meetings has provided good opportunities to the Society to exchange the ideas, share experiences and to promote mutual cooperation.

As a General Secretary of NGS, I took part in the Regional Workshop on Networking and Collaboration among nongovernmental organization of Asian Countries in Disaster Reduction and Response on 20-22 February 2002 in Japan. This workshop was jointly organized by Asian Disaster Reduction Centre (ADRC) and U/N Office for the coordination of Humanitarian Affairs (OCHA) Kobe. The Asian Disaster Reduction And Response Network has been developed among all participatory organization to exchange ideas and information as well as sharing of resources among the network members. The Society has a responsibility to promote the network or strengthen existing network at the national level. Respected members, to facilitate the exchange of information between NGOs, government organization and development organizations, in Nepal there is a disaster Preparedness Network (DP-NET) which was formed by the active involvement of the Nepal Red Cross Society. Respected members, the 11<sup>th</sup> Executive Committee has recently decided to be involved in DP-NET network. It will be beneficial to meet the objective and responsibility of the Society in the disaster preparedness.

The Executive Committee is very much aware of the fact that there are increasing numbers of unemployed and partially employed Nepalese young geologists in the country. We were aware of the fact when we took over the charge of Executive Committee one year back. The situation through which the country is passing at the moment is not favourable at all for any employment generating activity not only because of the state of emergency but also due to lack of government plans and programs to create new jobs. However, the executive committee is doing its best to cope with the situation and trying hard for the generation of new employment opportunities for the geoscientists in the different ministries and departments of His Majesty's Government of Nepal. In this connection, the delegation of the Executive Committee of the Society has recently met with the concerning authority of the Ministry of General Administration. We have got positive response on this matter. The executive committee is committed to continue the same in future.

Dear Members, whatever we are able to do during the year are due to your kind help, enough support and advices. On behalf of the Executive Committee and myself, I would like to offer our sincere thanks to all of you for your active cooperation and continued support all the time. Various governmental and non-governmental organizations and agencies have provided technical and financial support to

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to  
the Nepal Geological Society

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the society. The 11<sup>th</sup> Executive committee would like to thank those organizations and agencies and hopes that such co-operation will be continued in the future as well. Particularly, I would like to mention here the following organizations:

Department of Mines and Geology  
Department of Irrigation,  
Department of Narcotics Control and Disaster management  
Nepal Electricity Authority  
Petroleum Exploration Promotion Project  
Groundwater Resources Development Project  
Central Department of Geology, T.U  
Department of Geology, Tri-Chandra Campus, T.U  
Department of Soil Conservation,  
Department of Water Induced Disaster Prevention  
Department of Electricity Development  
Impregilo sp A, Kaligandaki "A" Hydroelectric Project  
UNDP/Nepal  
BGR/Germany  
NORPLAN  
Godawari Marble Industry, Middle Marsyandi  
Hydropower Project, Hetaunda Cement Industry

Nepal Coal Association  
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We would also like to extend our sincere thanks to Mr. N.R. Sthapit, Director General, Department of Mines and Geology for providing office room, logistic support and other facilities needed for the Society. While working, there may have been shortcomings and weakness from our part. For this, I would like to take this opportunity to extend our sincere apology on behalf of the Executive Committee. Also, at this moment We would like to renew our request once again for the continuation of your support, advice and co-operation as well as to point out our weakness. We sincerely hope that we will be guided by the respected members of the Society in the future.

Respected members, the rules and regulation subcommittee of the Society has given some suggestions for the Executive Committee and the 11<sup>th</sup> Executive Committee has agreed to table in the General Body meeting of the Society for discussion and approval.

Respected members, now I would like to open the floor for discussion, suggestion and finally approval of our proposals.

Thank you.

### Annual Financial Report by Dr. Tara Nidhi Bhattarai, Treasurer, NGS

श्रीमान् सभापति ज्यू,  
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समाजका आदर्शिय एवं अव्यक्त ज्यूहरू,  
एवं उपस्थित सम्पूर्ण सदस्य-सार्थीहरू,

सर्वप्रथम म नेपाल भौगर्भिक समाजको २२ औं साधारण सभामा उपस्थित हुनु भएकोमा सम्पूर्ण सदस्य सार्थीहरूलाई हार्दिक स्वागत तथा अभिवादन टुकायाउन चाहन्छु। गत एक वर्षमा भएका समाजका विविध कार्यक्रमहरूको बारेमा समाजका महासचिव श्री राजेन्द्र खनाल ज्यू बाट वार्षिक प्रतिवेदन यहाँहरू समक्ष प्रस्तुत भैसकेको नै छ। अब म कोषाध्यक्षको हैसियतले आर्थिक वर्ष २०४८/४९ को वार्षिक प्रतिवेदन पेश गर्न चाहन्छु। समाजको विधानमा व्यवस्था भए बमोजिम पत्रिकृत लेखा गरि अकबाट समाजको हिस्सा फिर्ता लेखा परिक्षण गराई उपलब्ध Balance Sheet यहाँहरू समक्ष प्रतिकायाको लागि राखिसकेको छु। आशा छ यहाँहरूले उक्त Balance Sheet घण्टि गरिसक्नु भएको नै छ।

भर्खरै महासचिव ज्यूले भन्नु भए भई, समाजले गत साल सञ्चालन गरिराखेका कार्यक्रमहरू मध्ये 3rd Nepal Geological Congress को भूमिका अत्यन्त महत्वपूर्ण रहेको तथ्य सर्व विदितै छ। उक्त कार्यक्रमको खर्चको विवरण यस प्रकार रहेको छ।

आम्दानी :	४,६०,१२२/-
खर्च :	३,४६,०४४/-
बचत :	१,१४,०७८/-

गएको साल हामीले कार्यभार सम्हाल्दा समाजसँग मौज्जात रकम रु. २६,००,२७७.७५ भएकोमा अहिले खाचण मसाला सम्ममा समाजको नाममा रहेका विभिन्न बैंक खाताहरूमा रु. २६,४२,४६२.१० रहेको छ। यसरी समष्टिमा हेर्दा आर्थिक वर्ष ०४८/०४९ मा समाजले २,४२,२८४।३४ बचत गरेको कुरा यहाँहरू सबैमा अनुरोध गर्दै मेरो सानो भनाई यहाँ टुहपार्दछु।

Best Wishes  
and  
Hearty Felicitations  
to  
**Nepal Geological Society**  
***PREM COAL UDDYOG***  
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Exploration, Evaluation, and Development Scheme of Mineral Resources



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Heavy Duty Rotary Drill

Light Rotary Drill

Portable Rotary Drill

Portable Mechanical Rotary Drill

Percussion Drill

Heavy Duty Pressure Pump

Medium Duty Pressure Pump

Light Duty Pressure Pump

NQ Wireline Drill Assembly

Pile Hole Drill Assembly

Flight Augur with Under Reamer

Packer Test Assembly

Hi-Volt Generator for Underground Work

Rock and Soil Testing Equipment

***Our capacity: Go 300 m down***



**Auditor's Financial Report of Fiscal Year 2058/059**

The Members  
Nepal Geological Society  
Kathmandu

Gentlemen,

I have audited the attached Receipt and Payment Account for the year ended on 31st Shrawan, 2059, and reported as follows:

1. I have got all the information and explanations which are required for the purpose of audit.
2. Proper books as required are maintained according to Company's Law.
3. The attached Receipt and Payment Account and Income and Expenditure Account are drawn properly up in accordance with records which are made available to me.
4. According to the information given to me the attached Income and Expenditure Accounts prepared for the year ended 31st Shrawan 2059 exhibit true and fair view.

*Sd.*

**(Babu Raja Bajracharya)**  
Registered Audit

Date: 31st Shrawan 2059

With the Best wishes

from

**GANESH HIMAL ZINC-LEAD PROJECT**



**NEPAL METAL COMPANY LIMITED**

13 Gyan Marg, Gyaneshwor

Post Box 468, Kathmandu, Nepal

Phone: 4412 657, 4410 210 Fax: 00977-1-4410 210

Email: nmetal@htp.com.np

# Nepal Geological Society

## RECEIPT AND PAYMENT ACCOUNT

For the year ended 31 Shrawan 2059

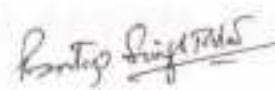
### Nepal Geological Society RECEIPT AND PAYMENT ACCOUNT For the year ended 31st Shrawan 2059

Receipt	Amount(Rs)	Payment	Amount(Rs)
To Bank	2,596,656.75	By Advance	28,246.00
To Cash	3,621.00	By Advertisement	30,318.00
To Advertisement	38,500.00	By Audit fee	5,000.00
To Contribution	524,950.00	By Bank commission	660.47
To Contribution \$5640	443,304.00	By Seminar bag and T-Shirt	140,335.00
To Interest Received	20,528.56	By Catering service	191,050.00
To Interest Received \$300.46	23,616.16	By Computer accessory	11,750.00
To Miscellaneous Income	9,375.00	By Furniture	12,650.00
To Miscellaneous Income \$289.16	22,729.55	By Fuel	5,087.00
To Journal sale	77,426.25	By Hotel Bill	306,006.00
To Journal sale \$310	24,366.00	By Miscellaneous Expenses	20,750.00
To Journal subscription	1,973.50	By Map purchase	20,400.00
To Journal subscription \$20	1,572.00	By Photocopy	9,185.50
To Life Membership Fee	36,400.00	By Postage and Communication	25,413.00
To Membership Fee	12,435.00	By Printing and Press	406,850.00
To Associate Membership Fee	1,700.00	By Refreshment	25,378.00
To Geological Map sale	13,050.00	By Rent	38,400.00
To Registration (3rd Congress)	374,425.00	By Remuneration and wages	60,455.00
To Registration (3rd Congress) \$395	31,047.00	By Repairs and maintenance	6,500.00
To Miscellaneous Income			
(Difference in Exchange rate on \$)	76,741.13	By Stationery	38,710.00
		By Transportation	18,692.00
		By Tax on interest	3,277.70
		By Agri. Dev. Bank(Fixed)	55,000.00
		By Agri. Dev. Bank(Saving)	362,703.72
		By Nabil k (Saving)	286,520.84
		By Nabil (Fixed)	29,000.00
		By Nabil Dollar A/C(Saving) \$27479.96	2,159,924.86
		By Nepal Bank(Fixed)	37,000.00
		By Nepal Bank(Saving)	9,204.13
		By Nepal Bank(Current)	9,949.68
<b>Total</b>	<b>4,334,416.90</b>	<b>Total</b>	<b>4,334,416.90</b>

(US\$1=NRs 78.60)

  
Treasurer  
Dr. T.N. Bhattarai

  
General Secretary  
Rajendra Khatri

  
President  
Pratap Singh Taler

  
Auditor  
Baburaj Bapacharya

# Nepal Geological Society

## INCOME AND EXPENDITURE ACCOUNT

For the year ended 31 Shrawan 2059

## Nepal Geological Society INCOME AND EXPENDITURE ACCOUNT For the year ended 31<sup>st</sup> Shrawan 2059

Expenditure	Amount(Rs)	Income	Amount(Rs)
To Advance	28,246.00	By Advertisement	38,500.00
To Advertisement	30,318.00	By Contribution	524,950.00
To Audit fee	5,000.00	By Contribution \$5640	443,304.00
To Bank commission	660.47	By Interest Received	20,528.56
To Seminar bag and T-shirt	140,335.00	By Interest Received \$300.46	23,616.16
To Fuel	5,087.00	By Miscellaneous Income	9,375.00
To Photocopy	9,185.50	By Miscellaneous Income \$289.18	22,729.55
To Postage and Communication	25,413.00	By Journal sale	77,426.25
To Printing and Press	406,850.00	By Journal sale \$310	24,366.00
To Refreshment	25,378.00	By Journal subscription	1,973.50
To Rent	38,400.00	By Journal subscription \$20	1,572.00
To Remuneration and wages	60,455.00	By Life Membership Fee	36,400.00
To Repairs and maintenance	6,500.00	By Membership Fee	12,435.00
To Stationery	38,710.00	By Associate Membership Fee	1,700.00
To Tax on Interest	3,277.70	By Geological Map sale	13,050.00
To Transportation	18,692.00	By Registration (3 <sup>rd</sup> Congress)	374,425.00
To Catering service	191,050.00	By Registration (3 <sup>rd</sup> Congress) \$395	31,047.00
To Computer accessory	11,750.00		
To Furniture	12,650.00		
To Hotel Bill	306,006.00		
To Miscellaneous Expenses	20,750.00		
To Map Purchase	20,400.00		
Surplus(Profit)	252,284.35		
<b>Total</b>	<b>1,657,398.02</b>	<b>Total</b>	<b>1,657,398.02</b>

(US\$1=NRs. 78.63)

  
Treasurer  
Dr. T.N. Shattara

  
General Secretary  
Rajendra Khana

  
President  
Pratap Singh Taser

  
Auditor  
Baburaj Bajracharya





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(The only name in Well Drilling)

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- Pump test and water analysis
- Development and rehabilitation of tube wells
- Natural gas well design, complete gas well installation and distribution system
- Consultancy services in hydropower, water supply, irrigation, roads, building and other civil engineering projects
- Studies on land degradation, pollution, natural hazard, environmental impacts, agricultural productivity.

## **For more information**

<b>Contact:</b>	PO. Box:	1192, Ring Road, Lalitpur, Nepal
	Tel.:	5538325
	Fax:	977-1-5520242
	E-mail:	<a href="mailto:eward@wlink.com.np">eward@wlink.com.np</a>

## नेपाल भौगर्भिक समाजको तेइसौँ वार्षिक साधारण सभामा भएका छलफल तथा निर्णयहरू

वार्षिक प्रतिवेदन प्रस्तुति पछि एजेण्डा अनुसार छलफलको क्रममा Rules & Regulation Committee का सभोजक श्री पुरुषोत्तम राज जोशीले निर्वाचन संग सम्बन्धित विशेष नियमावली हुन आवश्यक देखिएको र समाजको विद्यमान विधानमा खासगरी सदस्य र सह सदस्य हुनका लागि चाहिने योग्यता र समाजको अध्यक्ष, उपाध्यक्ष, महासचिव, उपमहासचिव लगायतका अन्य पदहरूमा उम्मेदवारी दिनुको लागि समाजको सदस्यता लिएको निश्चित अवधि तोकिनु पर्ने सल्लाह राख्नु हुँदै यो समाज जस्तै अन्य पेशागत समाजहरूले (Professional Societies) जस्तै नेपाल इन्जिनियरिङ एसोसियसन (संघ र संगठनहरू)मा पनि यस्तो किसिमको प्रावधान भएकाले यस सम्बन्धमा आवश्यक छलफल गर्नु पर्ने आवश्यकता औल्याउनु भयो। तत्पश्चात् समाजका आजीवन सदस्य श्री जगदिश्वर नाथ श्रेष्ठले यस्ता सुझावहरू राख्नु राम्रो हो तर निर्णयको लागि समाजको विधान अनुसार अर्को साधारण सभामा मात्र निर्णय गर्ने सकिने कुराको जानकारी दिलाउनु भएको थियो। समाजका अर्का पूर्व अध्यक्ष श्री जम्जुनानन्द भण्डारीले विधान संशोधन गर्ने हतार गर्न नहुने सुझाव दिनु भएको थियो भने सामाजका अर्का पूर्व अध्यक्ष डा. श्री विशाल नाथ उप्रेतले विधान संशोधनको लागि एउटा विशेष समिति नै गठन गर्नु पर्ने र सो को लागि अर्को साधारण सभाको आवश्यकता पर्ने हुनाले यसमा छलफल गर्न मात्र सकिने राय व्यक्त गर्नु भयो। यसका साथै समाजका सदस्य श्री गणेश मैनातिले का.का.स. को अध्यक्ष लगायत अन्य पदहरूमा उम्मेदवारी दिनुको लागि न्यूनतम ३ वार्षिक NGS को साधारण सदस्यता लिएको व्यक्तिले मात्र उम्मेदवारी दिन सक्ने जस्ता सुझावहरूमा असहमति प्रकट गर्नु भएको थियो।

समाजका आजीवन सदस्य डा. श्री मेघ राज धितालले जियोलोजीमा मास्टर्स डीग्री गरेका व्यक्तिको पल्वाक इन्जिनियरिङ क्याम्पसमा Geo-Tech Engineering संग सम्बन्धित विषयमा अध्यापन गर्ने पाउँछन् तर Geology विषय लिएर M.Sc. पास गरेका विद्यार्थीहरूले M.E. पढ्न पाउँदैनन्। त्यसैले सकारणका सम्बन्धित निकायहरूमा सोसाइटी आफ्नो विशेष पहल गर्नुपर्ने आवश्यकता औल्याउनु भयो। यसै क्रममा उहाँले भन्नु भयो, हामी Landslide लगायत अन्य धुपै Disasters सम्बन्धित कुराहरू गर्वही तर वास्तविक रूपमा काम गर्न सकिराखेका छौंती त्यसैले अब त्यस्ता कार्यहरूमा पनि हामी समाजले ध्यान दिनु अनि आवश्यक भएको कुरा समेत डा. धितालले आफ्नो सल्लाहमा व्यक्त गर्नु भयो।

समाजका पूर्व महासचिव उत्तम बोल श्रेष्ठले आय व्यय विवरणको बारेमा समाजका कोषाध्यक्षज्यू संग जिज्ञासा व्यक्त गर्नु भएको थियो भने केहि साधीहरूले समाजले सदस्यता सम्बन्धित रेकर्ड up to date राख्नु पर्ने सुझाव दिनु भएकोमा समाजका अध्यक्ष श्री प्रताप सिंह तानेडले हाल समाजसंग कुनै कर्मचारीहरू पनि नभएको र खास निश्चित अफिस पनि नभएकोले यस सम्बन्धमा आवश्यक कार्य छिटो गर्ने तर्किएको हो भन्नु भयो। यसै गरी समाजको अफिसको लागि घर, जग्गा किन्ने सम्बन्धमा सोधिएको परतमा अझथले जग्गा, भवन लगायत अन्य कार्यको लागि

छिटो कार्य चालनी गर्ने जानकारी दिनु भयो। यसै क्रममा Land & Building Management Committee का को-अर्डिनेटर श्री अच्युतानन्द भण्डारीले हालसम्म समाजको जग्गाको खरीदको लागि बैराखेको कार्य प्रगति बारेमा सवैलाई जानकारी दिलाउनु भयो।

उक्त अवसरमा यस समाजका पूर्व अध्यक्ष एवं Editorial Board का Chief Editor Prof. B.N. Upreti ले सोसाइटीको जर्नल तथा बुलेटिन प्रकाशन सम्बन्धी बैराखेका कार्यको जानकारी दिलाउनु भएको थियो भने समाजका सम्पूर्ण सदस्य सावीरकुललाई १९ वटा जर्नल किनौ सोसाइटीलाई सहयोग गर्ने तथा Journal Subscribe गर्नको लागि अनुरोध गर्नु भएको थियो।

यसै क्रममा यस समाजका Socio-cultural Relation Committee का को-अर्डिनेटर श्री वीरेन्द्र पियाले आगामी दिनहरूमा गर्नुपर्ने कार्यहरू जस्तै Blood Donation कार्य छिटै गरिने जानकारी दिलाउनु भयो।

यसैगरी छलफललाई जगाडी बढाउने क्रममा यस समाजका सदस्य श्री प्रकाश घिमिरेले M.Sc. नुगर्म विज्ञानमा सर्वप्रथम हुने विद्यार्थीलाई Gold Medal र यससमाजको आजीवन सदस्य (Life Membership) प्रदान गर्नु भन्दा नीजलाई Research कार्यको लागि केहि आर्थिक सहयोग समाजका तर्फबाट उपलब्ध गराउँदैनु उत्तम हुने सन्तुष्ट दिनुभयो। यस सम्बन्धमा अध्यक्ष श्री तानेडले यसको लागि आवश्यक रकम जुटाउन सकिनेमा मात्र सो कार्य गर्न सम्भव हुने जानकारी दिनुभयो। सो सभामा समाजका आजीवन सदस्य श्री गोपाल नकर्माले हुनाले के गर्ने सन्तुष्ट भन्ने विषयमा लेखहरूको संकलन गर्नको लागि समाज एवं समाजका सदस्यहरूले नै विशेष पहल गर्ने अनुरोध समेत गर्नु भएको थियो। यसै गरी समाजका अर्का सदस्य श्री नारायण घिमिरेले Geologist हरूलाई Engineering Council को सदस्यता दिलाउन भौगर्भिक समाजको तर्फबाट उक्त Council संग पुन एक पटक भेटवार्ता एवं छलफल गर्नु पर्छ भन्ने सल्लाह दिनु भएकोमा समाजका अर्का सदस्य श्री विप्रसाद धौमडेलले Geologist हरूलाई सदस्यता दिलाउन पुर्ब का.का.स. ले धेरै प्रयास गरेको हो तर उक्त Council ले Engineering Council को सदस्यता दिन ताना प्रकारको कुरा राखी सदस्यता नदिएको हुँदा पुन सदस्यताको लागि धाधना गर्नु भन्दा वरु छुट्टै एक Geological Council को गठन गर्न श्री ५ को सरकारसंग पहल गर्नु धेरै राम्रो हुने सुझाव दिनु भयो।

अन्त्यमा समाजका अध्यक्ष श्री तानेडले विधान सम्बन्धी कार्य गर्नका लागि एक छुट्टै Rules & Regulation Committee को गठन र सो समितिको सभोजक तथा सदस्यहरूको मनोनयन समाजको कार्यकारिणी समितिले यथाशिघ्र गर्ने जानकारी दिए पश्चात् सर्व सम्मत रूपमा सो प्रस्ताव पारित गरीएको थियो। तत् पश्चात अध्यक्ष श्री तानेडले उपस्थित सबै सदस्यज्यूहरूलाई पुन एकपटक धन्यवाद प्रकट गर्दै २३ औं वार्षिक साधारण सभा अन्त्य गर्नु भएको थियो।



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## WORKSHOP ON "ROLE OF GEOSCIENCE IN MINERAL RESOURCES DEVELOPMENT AND PROMOTION OF MINERAL BASED INDUSTRIES IN NEPAL"

(नेपालमा रहेका खनिज सम्पदाहरूको विकास, खनिज उद्योग प्रवर्धन तथा स्थापनामा भूविज्ञानको भूमिका बारे एकदिने कार्यशाला गोष्ठी)

यही ३० श्रावण २०५९ का दिन नेपाल भौगर्भिक समाजले खानी तथा भूगर्भ विभागको सहयोगमा "नेपालमा खनिज सम्पदाको विकास, खनिज उद्योग प्रवर्धन तथा स्थापनामा भू-विज्ञानको भूमिका" विषयमा आयोजना गरेको एक दिने कार्यशाला गोष्ठी रसी सांस्कृतिक केन्द्र, कमलपोखरी, काठमाडौंमा सफलता पूर्वक सम्पन्न भयो। उक्त गोष्ठीको समुद्घाटन प्रमुख अतिथि राष्ट्रिय योजना आयोगका माननीय सदस्य डा. शंकर शर्मा ज्ञवाट सम्पन्न भएको थियो। उद्घाटन समारोहको समापनित्व उद्योग, वाणिज्य तथा आपूर्ति मन्त्रालयका निर्मित सचिव श्री राम कृष्ण पन्तज्यूले गर्नु भएको थियो।

उद्घाटन समारोहको क्रममा सर्वप्रथम नेपाल भौगर्भिक समाजका अध्यक्ष श्री प्रताप सिंह तानेज्यूले स्वागत भाषण गर्नु भएको थियो भने कार्यशाला गोष्ठी आयोजक समितिका संयोजक श्री कृष्ण प्रसाद काफ्लेले कार्यशाला गोष्ठीको उद्देश्य र औचित्य बारे विस्तृत रूपमा प्रकाश पार्नु भएको थियो।

उद्घाटन भाषणको क्रममा प्रमुख अतिथि माननीय श्री डा. शर्माले सर्वप्रथम ने.जी.स. ले संचालन गर्दै आएका कातिपय कार्यक्रमहरू मध्ये अन्तर्राष्ट्रिय स्तरको सीमानार, सम्मेलन एवं जनरलहरूको नियमित प्रकाशन र वितरण गर्ने सफल भएकोमा यसको सन्ताना गर्नु भयो। उक्त कार्यशाला गोष्ठीको उद्देश्य धेरै नै सम्मानार्थक भएको र यसरी खनिज संग सम्बन्धित सबै पक्षलाई एकैठोमा भेलागराई युक्त छलफल एवं अन्तरक्रिया गराएर निस्कने निबोधले आठै दिनहरूमा नेपाल अधिराज्यमा प्राप्त खनिज सम्पदाहरूको धडी विकास भई देशमा थप खानी एवं खनिज उद्योगहरू स्थापना तथा संचालन हुने र सो बाट देशको आर्थिक स्थिति उत्कृष्ट योगदान पुर्नकासाथै यसमा हाल दखापरेका कर्म कमजोरी, कठिनाई एवं समस्याहरू पत्ता लगाई समाधानका उपायहरू समेतको ठोस सुझावहरू प्राप्त हुनेछ भन्ने आशा राख्नु भएको थियो।

उक्त अवसरमा खानी तथा भूगर्भ विभागका महानिर्देशक श्री तन्दराम स्थापितज्यूले खानी तथा भूगर्भ विभागको उद्देश्य र यसले गर्दै आएका मुख्य मुख्य कार्यहरू र आगामी दिनहरूमा संचालन गर्ने कार्यक्रम तथा खनिज ऐन तथा नियम बारे प्रकाश पार्नुका साथै खनिज उद्योगहरूलाई खनिज उद्योगमा थप लगानी गर्ने अनुरोध गर्नु भएको थियो।

उद्घाटन समारोहको अन्तमा समारोहका समापनित्व उद्योग, वाणिज्य तथा आपूर्ति मन्त्रालयका निर्मित सचिव श्री राम कृष्ण पन्तज्यूले यस कार्यशाला गोष्ठीको औचित्य बारे प्रकाश पार्नु भएको थियो भने नेपाल भौगर्भिक समाजका महासचिव श्री राजेन्द्र प्रसाद खनालले आमन्त्रित सर्वे महानुभावहरू र सहयोगी मन्त्रालयलाई धन्यवाद ज्ञापन गर्नु भएको थियो। उक्त कार्यशाला गोष्ठीमा श्री ५ को सरकारका मन्त्रालय, विभाग एवं विभूत विश्वविद्यालयका प्रतिनिधिहरू लगायत नेपाल त्रिभुवन प्राधिकरण, खनिज उद्योग, खानी मध्य, खनिज तथा निर्माणसंग सम्बन्धित कन्सल्टीङ फर्म, जिलाविकास समिति, तहसीपालका आदिका प्रतिनिधिहरू र विभिन्न

क्षेत्रमा कार्यरत भूविज्ञानिकहरू तथा भूगर्भ विज्ञानमा अध्ययनरत विद्यार्थीहरूको पनि उपस्थिति रहेको थियो।

उक्त कार्यशाला गोष्ठीको मुख्य उद्देश्य भूगर्भ विज्ञान बारे नेपालमा दिइने शिक्षा, खनिज अन्वेषण, खनिज उत्खनन तथा खनिज उद्योग प्रवर्धन एवं संचालन कार्यमा कार्यरत भूविज्ञानिकहरू, खनिज उद्योगहरू तथा लगानी कर्ताहरूलाई एकै ठाउँमा भेला गराई आफुले प्राप्त गरेका ज्ञान, सीप, अनुभवहरूको आदान प्रदान गर्ने एवं खानी तथा खनिज उद्योग संचालनमा देखा परेका कमी, कमजोरी, कठिनाई र मौजूदा ऐन नियममा रहेको विरोधाभास पूर्ण प्रावधानले गर्दा खनिज उद्योगलाई पने गएका समस्याहरू सुल्झाउन के कस्तो समसामयिक सुधार गर्नु पर्छ आदि बारे छलफल गरी समाधान खोज्ने भएको कुरा संयोजक श्री काफ्लेले व्यक्त गर्नु भएको थियो।

उद्घाटन समारोहको कार्यक्रम पश्चात् गोष्ठीको मुख्य कार्यक्रमलाई तीन सत्रमा विभाजन गरि पहिलो दुई सत्रमा विभिन्न क्षेत्रमा अनुभव प्राप्त गर्नु भएका व्यक्तित्वहरूले निम्न पाँच विषयमा कार्यपत्रहरू प्रस्तुत गर्नु भएको थियो।

- (1) Geoscience Education in Professional Manpower Development in Nepal (नेपालमा पेशागत जनशक्ति विकासमा भूविज्ञानको योग्यता): By: P.C. Adhikary, Head, Central Department of Geology/ TU.
- (2) Investment Opportunities in Mineral Sector in Nepal (नेपालमा खानी तथा खनिज उद्योग विकासमा लगानीका अवसर हरू): By: B.M. Jnawali and K.P. Kaphle, Department of Mines and Geology, HMG.
- (3) Mineral Industries and their contribution in National Economy (नेपालमा सन्चालित खानी तथा खनिज उद्योगहरू र तीनवटा राष्ट्रिय अर्थतन्त्रमा पुर्‍याएको योगदान): By: B.R. Aryal and J.N. Shrestha, Department of Mines and Geology, HMG.
- (4) Problems and Issues in operation of Mines and Mineral based Industries in Nepal (नेपालमा खानी तथा खनिज उद्योग संचालनमा देखापरेका समस्या र कठिनाई): By: Arun Kediya and R.S. Mandal, Godavari Marble Industries (P) Ltd, Godavari.
- (5) Present Status and Issues in Exploration and Exploitation/ Mining of Mineral Resources in Nepal (नेपालमा खनिज अन्वेषण, खानी उत्खनन र माना खनिज उद्योग संचालनमा हालको अवस्था र उद्योगले भोग्नुपरेका समस्याहरू): सम्बन्धमा नेपाल खनिज उद्योग संघका अध्यक्ष श्री नृपन सात क्षेत्र र नेपाल कोइला खानी उद्योग व्यवसायी संघका अध्यक्ष श्री जादवु शेर्पाले पेश प्रस्तुत गर्नु भएको थियो।



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उक्त कार्यपत्रहरूमा कमला बाँस्मि भूगर्भविद् एवं हिमाल सिमेन्ट उद्योगका महाप्रबन्धक श्री रमेश कुमार अर्वाल, उद्योग वाणिज्य तथा आपूर्ति मन्त्रालयका उपसचिव श्री उद्धव अधिकारी, उदयपुर सिमेन्ट उद्योगका भू भू, महाप्रबन्धक श्री तेजकान्त झा, खानी तथा भूगर्भ विभागका सुपेरिटेन्डिङ भूगर्भविद् श्री पुरुषोत्तमराज जोशी र वरिष्ठ माइनिङ इन्जिनियर एवं खानी तथा भूगर्भ विभागका उपमहानिदेशक श्री प्रणव लाल श्रेष्ठज्यूबाट टिप्पणी गरिएको थियो। हरेक कार्यपत्रमा टिप्पणी प्रस्तुत गरिए पश्चात् उक्त विषयहरूमा सहभागीहरू बीच खुल्ला छलफल एवं अन्तर्क्रिया गरिएको थियो। उक्त छलफलमा सहभागीहरूले सक्रिय भाग लिनु भई सहत्वपूर्ण सुझावहरू दिनु भएकोमा यो मध्ये विषयवस्तु संग सम्बन्धित मुख्य मुख्य बुदाहरू र कार्यक्रमको अन्त्यमा Concluding Session (विश्लेषण सब) मा प्रस्तुत भएका बुदाहरूलाई समेत समेटी निम्न प्रमोक्षित सुझावहरू (Recommendation) प्रस्तुत गरिएका थिए।

### सुझावहरू (Recommendation)

- खानी तथा खनिज पदार्थ ऐन २०४२, रन ऐन २०४९, तथा स्थानीय स्वायत्त शासन ऐन, २०५४ मा खनिज खोजन (Mineral Exploitation), खानी प्रशासन र खनिज पदार्थबाट रोयल्टी समेतमा राजस्व असुल उपर गर्ने सम्बन्धमा र खानी एवं खनिज उद्योगहरूलाई दायीर तहसँग रोयल्टी तथा रै इस्त्रुत बुझाउनु परेकोले यथाशीघ्र परिमार्जन गरी अप्रत्यक्ष निराकरण गरी खनिज उद्योगी तथा लगानिकर्ताहरूलाई लगानी गर्ने बातावरण सिर्जना गर्नुपर्ने।
- खानी उत्खनन तथा खनिज उद्योगहरूलाई घरेलु उद्योग (Cottage Industries) को रूपमा नतिई मौजुदा नीयममा उल्लेख भए अनुसारको प्रतिमाना र माना स्तरका खनिज उद्योगहरूलाई दिइएको उत्खनन अवधि अपघात छ, यो अवधि बृद्धि गरिनु पर्ने माग रहेको।
- खानी तथा भूगर्भ विभाग श्री ५ को सरकारको एकमात्र खनिज विकास कार्य सम्बन्धि समेकायवाला एवं आधिकारिक निकाय भएको र विभागमा मात्र खानी सम्बन्धित विशेषज्ञहरू (भूगर्भविद् एवं माइनिङ इन्जिनियर) भएको हुँदा सबै प्रकारका खनिज खोजि एवं खनिज उत्खननको इजाजतपत्र दिने, खानीहरूको निरीक्षण एवं बातावरणीय अनुगमन गर्ने, दण्ड सजाय दिने आदि विभागबाटै गर्ने गराउनु पर्ने र हाल जि.वि.स.मा कुनै पनि सम्बन्धित विज्ञ तभएको हुँदा निर्माणमूर्खी खनिज लगायन खानी एवं खनिज सम्बन्धि सम्पूर्ण काम गर्ने अधिकार खानी तथा भूगर्भ विभागलाई नै दिनु पर्ने कुरामा सम्पूर्ण खनिज उद्योगहरूको भनाई रहेको हुँदा श्री ५ को सरकारको यसमा ध्यानाकर्षण हुनु पर्ने।
- खानी तथा भूगर्भ विभागलेनै एकीकृत खनिज अन्वेषण तथा खनिज उद्योगहरू प्रबर्धन एवं विकास गर्ने काममा अग्रसर हुनु पर्ने र हाल अधिराज्यका विभिन्न स्थानमा सिमेन्ट उद्योगको नाममा अनियोजित रूपमा खुल्दै गरेका र आपातित Clinker मा आधारित उद्योगहरूलाई निरुत्साहित गरी आफ्नै देशमा प्रचुर मात्रामा रहेका चुनदुडाहरूको प्रयोग गरी सिमेन्ट उद्योगहरू स्थापना गर्नुपर्ने कुरामा सबै सहभागीहरूको एकमत रहेको।

- अन्य उद्योग सरह खानी तथा खनिज उद्योगीहरूको खनिज उत्खनन अनुमतिपत्र पनि नामसारी गर्ने पाउनु पर्ने गरी कानूनी प्रावधान गरिनु पर्ने माग रहेको।
- खानी तथा खनिज उद्योगहरूले सम्बन्धित विशेषज्ञको राय, सल्लाह, सुझाव लिई माइनिङ प्लान (Mining Plan) तयार गरी सोहि अनुसार उत्खनन गर्नु पर्ने र सोको प्रगति निर्धारित रूपमा खानी तथा भूगर्भ विभागमा दिनु पर्ने।
- सम्बन्धित निकायले कुनै पनि खनिज भण्डारको मूल्याङ्कन गर्दा Overburden के कति छ र त्यसलाई कुन प्रयोजनको लागि प्रयोग गर्ने सकिन्छ भन्ने कुरालाई समेत विचार गरी Overburden Material को पनि सदुपयोग गर्ने गरी Mining Plan तयार गरी खानी उत्खनन गर्नु पर्ने।
- खानी तथा भूगर्भ विभागले खानी अनुमतिपत्र जारी गर्दा सडक किनार (Road Side)बाट ५०० मि. भित्र Stone Quarry/mine तथा Stone Crushing Plant राख्न दिनु नहुने र यसलाई सबै तहबाट कडाईकासाथ पालना गर्ने गराउने।
- खानी एवं खनिज उद्योगबाट पर्ने सक्ने बातावरणीय झसलाई IEE/EIA अध्ययन गराई कमभन्दा कम क्षति हुने गरी खानी सञ्चालन गर्ने गराउने र खानी एवं खनिज उद्योग क्षेत्र स्थापना भई सकेपछि उक्त क्षेत्रमा वन विकास एवं वन विकास तथा नैसर्गिक विविधता जस्ता कुराहरूको विकास गर्ने प्रोत्साहन गर्ने नीति हुनुपर्ने। खनिज उत्खनन गर्दा बातावरणीय पक्षलाई ध्यान दिई Eco Friendly Green Mining को अवधारणा अनुसार खानी उत्खनन गर्ने।
- श्री ५ को सरकारले भौतिक पूर्वाधार (Infrastructure) सस्ती-सडक, विद्युत, संचार आदिको सुविधा पुर्‍याएर, कर प्रणालिमा केही राहत (Relaxation), विद्युतमा विशेष सहनियत, थप ऐनमा सुधार गरेर र एकद्वार प्रणालि अवलम्बन गरी खानी तथा खनिज उद्योगमा स्वदेशि तथा विदेशि लगानीकर्तालाई आकर्षण गर्ने नीति अवलम्बन गर्नुपर्ने।
- खानी तथा खनिज उद्योगहरूमा राजनैतिक हस्तक्षेप हुन नहुने र सोहि स्थानमा सहि न्याक्ति (Right man in Right Place) नियुक्त गर्नु पर्ने र थप ऐनमा भएको कामदारमूर्खी प्रावधानमा समसामयिक सुधार गरिनुपर्ने।
- केमिकल ग्रेड (Chemical grade), चुनदुडा (limestone) का भण्डारहरूबाट साधारण पोर्टलेण्ड सिमेण्ट बनाउन प्रयोग गर्नुको सट्टा क्वाइट सिमेण्ट, Calcium Carbide र अन्य केमिकल जस्ता अधिक मूल्यपने वस्तु उत्पादन गर्ने काममा प्रयोग गरिनु उपयुक्त हुने भएकोले तदनुरूप श्री ५ को सरकार को नीति जारी गरिनुपर्ने।
- विश्वविद्यालयहरूले आफ्नो Course of Study लाई देशको आवश्यकता अनुसार परिमार्जन गरी M.Sc. को अग्लिम (दोस्रो) वर्षमा विभिन्न विषयमा Specialization गराउने र



M.Sc. पछि पनि specialization को लागि विशेष कोर्सको व्यवस्था गरी M.Phil., Ph. D. गराउनु पर्ने।

१४। विभुवन विषय विद्यालय केन्द्रिय भूगर्भ शास्त्र विभाग तथा खानी एवं खनिज उद्योगहरूले आवश्यक Research Work गर्ने गराउन एक अर्कालाई सहयोग गर्ने गराउने।

१५। खानी तथा खनिज उद्योगहरू श्रममुलक क्षेत्र भएकोले अडिराज्यमा प्राप्त खनिज भण्डारहरूको अधिकतम विकास गरी खनिज उद्योग प्रवर्धन एवं स्थापना गरेमा रोजगारीका अवसरहरू बढ्न गई राष्ट्रिय अर्थतन्त्रमा उल्लेखनीय योगदान हुने र गरीब निवारणमा पनि टेवा पुग्ने भएकोले थ्री ५ को सरकारले खनिज उद्योगलाई प्राथमिकता दिई प्रोत्साहित गर्नु पर्ने।

१६। हालसम्म (गन ३६ वर्षमा) खनिज क्षेत्रमा गरिएको लगानीको तुलनामा प्रतिफल निकै बढी भएकोले थ्री ५ को सरकारले यस क्षेत्रलाई प्राथमिकता दिई खनिज सम्पदाको खोनी अध्ययन,

अनुसन्धान र अन्वेषण तथा विकास कार्यको लगानीमा बाँड्न गर्नु पर्ने कुरामा सबैको एकमत रह्यो।

१७। नेपाल भौगर्भिक समाजले खानी तथा भूगर्भ विभागको सहयोगमा आयोजना गरेको यस प्रकारको कार्यशाला गोप्य निकै उपयोगी एवं प्रभावकारी भएकोले भविष्यमा पनि समय समयमा यस्तै कार्यक्रम आयोजना गर्नुपर्ने र यस प्रकारको गोप्यमा राष्ट्रिय योजना आयोग, उद्योग वाणिज्य तथा आपूर्ति मन्त्रालय, वन तथा भूसंरक्षण मन्त्रालय, स्थानीय विकास मन्त्रालय, भौतिक योजना तथा निर्माण मन्त्रालय, जलस्रोत मन्त्रालय, खानी तथा भूगर्भ विभाग, वन विभाग, भूसंरक्षण विभाग, उद्योग विभाग, सडक विभाग आदिका प्रतिनिधिहरू, भूगर्भविदहरू र खानी तथा खनिज उद्योगीबीच बृहत् छलफल एवं अन्तर्क्रिया गराउन सकेमा खानी क्षेत्रमा विद्यमान समस्याका बारे सबै पक्षलाई ज्ञान हुने र विवाद भएका कुरामा तत्काल कारवाही जगाडी बढाई सोको निराकरण गर्न सजिलो हुने कुरामा सबै पक्षको सहमति रह्यो।

Best Wishes

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### Welcome Speech by Mr. P.S. Tater, President NGS

## नेपाल भौगर्भिक समाजका अध्यक्ष श्री प्रताप सिंह तातेडको स्वागत भाषण

श्रीमान् सभापति महोदय,  
श्रीमान् प्रमुख अतिथि ग यो आ. का माननीय सदस्य डा.शंकर शर्मा ज्यू,  
खानी तथा भूगर्भ विभागका महानिर्देशक श्री नन्दराम स्थापित ज्यू,  
श्री ५ को सरकार का अधिकारीज्यूहरु,  
बिभिन्न उद्योगबाट पाल्नु भएका प्रतिनिधी ज्यूहरु,  
पत्रकार बन्धु,  
यस समाजका पूर्व अध्यक्षज्यूहरु तथा समस्त सदस्य साथीहरु,  
महिला तथा सज्जनबन्धु,

नेपालमा खनिज सम्पदाको विकास, खनिज उद्योग प्रवर्धन तथा स्थापनामा भू-विज्ञानको भूमिका बारे एक दिन कार्यशाला गोष्ठी नेपाल भौगर्भिक समाज र खानी तथा भूगर्भ विभागको संयुक्त तत्वावधानमा आज सुरुम्पन्न हुन गइरहेको छ । हाम्रो विनम्र अनुरोधलाई स्वीकार गरी राष्ट्रिय योजना आयोगका माननीय सदस्य डा.शंकर शर्मा ज्यूले आफ्नो व्यस्त समयको बावजूद पनि प्रमुख अतिथ्य गृहण गर्नु भएकोमा म आयोजकको तर्फबाट माननीय सदस्यज्यूको हार्दिक स्वागत अभिवादन गर्दछु । यसै गरी यस उद्घाटन समारोहमा अध्यक्षता गृहण गरि यस समारोहको शोभा बढाई दिनु भएकोमा उद्योग, वाणिज्य तथा आपूर्ति मन्त्रालयका निमित्त सचिव श्री रामकृष्ण पन्तज्यूलाई पनि हार्दिक स्वागत गर्दछु । यसका साथै यहाँ पाल्नु भएका सम्पूर्ण अतिथि महिला तथा सज्जन बन्धुहरुलाई हार्दिक स्वागत गर्दछु ।

नेपाल भौगर्भिक समाज एक विशुद्ध पेशागत समाज हो । यसको मुख्य उद्देश्य राष्ट्र विकासमा भू-वैज्ञानिक तथा भूगर्भविदहरुलाई बढी भन्ने बढी संलग्नता गराउनु हो । यसै मन्दर्भमा भूगर्भविद तथा भू-वैज्ञानिकहरुले राष्ट्र विकासको अभियानमा जलश्रोत, खानी, सडक, वातावरण अध्ययन, भूकम्प जोखिम, बाढी पहिरो न्युनिकरण आदि कार्यमा आफ्नो पूर्ण योगदान पुऱ्याउँदै आएका छन् भन्ने श्री ५ को सरकारलाई पनि यस कार्य गर्नेमा सहयोग गर्दै आएका छन् ।

यस समाजले विभिन्न समयमा विभिन्न स्तरका राष्ट्रिय तथा अन्तर्राष्ट्रिय कार्यशाला, गोष्ठी, कन्फेस, वैज्ञानिक छलफलको आयोजना गर्दैआएको छ । यसै शिलशिलामा खनिज अन्वेषण, खानी उत्खनन तथा खनिजमा आधारित उद्योगहरुको विकासमा भू-वैज्ञानिक तथा भूगर्भविदहरुको के कस्तो भूमिका रहन्छ र रहेको छ तथा हाल विद्यमान खनिज उद्योग संचालनमा आई परेका समस्या र ती उद्योगहरुको अझ सुधार एवं प्रगतिगर्ने के कस्तो प्रकारको काम गर्नु जरुरी छ भन्नेबारे छलफल तथा अन्तर्राफ्रिचा गरी ठोस सुझाव दिन आजको यो गोष्ठी सफलहुने छ भन्ने आशा हामी आयोजकले गरेका छौ । त्यसका साथै विभिन्न निकायमा कार्यरत भूवैज्ञानिकहरु, श्री ५ को सरकारका विभिन्न निकायमा कार्यरत व्यक्तित्वहरु तथा खानी एवं खनिज उद्योगक्षेत्रमा संलग्न निजी उद्योगपतिहरु एउटै थलोमा बसेर छलफल गर्नाले खनिज उद्योगको नीति निर्धारणमा निश्चयनै ठूलो टेवा पुग्न सक्ने र खनिज उद्योग फस्टाउन सक्ने संभावनाको खोजी गर्ने पनि आजको यो कार्यशाला गोष्ठी सफल हुने छ भन्ने आशा एवं विश्वास लिएका छौ ।

भू-वैज्ञानिक तथा भूगर्भविदहरु प्रत्येक वर्ष करिब २०।२५ जनाका दरले विभिन्न विश्वविद्यालयबाट डिग्री हासिल गरी आई रहेका छन् नीजहरुलाई बढी भन्ने बढी खनिज विकास तथा भूगर्भ सम्पन्धी कार्यमा लगाउन सकिने भन्ने राष्ट्रको बेरोजगारी समस्यालाई केही हदसम्म भएपनि समाधान गर्न सकिनुका साथै राष्ट्रिय खनिज उद्योगहरुको विकास भई राजस्व आयमा पनि निश्चित रूपमा वृद्धि हुन जाने छ ।

तसर्थ खनिज सम्पदाको विकासको लागि भू-विज्ञानको भूमिका बारे गोष्ठीमा बढी भन्ने बढी छलफल गर्ने पाल्नु भएका समस्त महानुभावहरुलाई पुन एकपटक स्वागत गर्दछु

धन्यवाद !!!



## Speech by Mr. K.P. Kaphle, Convener, Organising Committee

(कार्यशाला गोष्ठिका कन्भिन्नर श्री कृष्ण प्रसाद काफ्लेले दिनुभएको मन्तव्य)

श्रीमान सभापति महोदय,

श्रीमान् प्रमुख अतिथि माननीय डा. शंकर शर्मा ज्यू, सदस्य राष्ट्रिय योजना आयोग

खानी तथा भूगर्भ विभागका महानिर्देशक, श्री नन्दराम स्थापित ज्यू,

ने.भौ.स.का अध्यक्ष श्री प्रताप सिंह तामेङ ज्यू,

श्री ५ को सरकारका उच्च पदस्थ अधिकृत ज्यूहरू,

सम्पूर्ण आदरणीय अतिथि महिला एवं सज्जनवन्द

यस समाजका सम्मानित सदस्य एवं पूर्व अध्यक्ष ज्यूहरू,

उपस्थित सम्पूर्ण सदस्य सार्थक ।

सर्वप्रथम म यस नेपाल भौगर्भिक समाजको कार्यकारिणी समितिले मलाई "नेपालमा खनिज सम्पदाको विकास, खनिज उद्योग प्रवर्धन तथा स्थापनामा भू-विज्ञानको भूमिका" बारे एक दिने कार्यशाला गोष्ठिको आयोजना गर्ने गठित आयोजक समितिको कन्भिन्नरमा मनोनयन गरि यो कार्यक्रम संचालन गर्ने भू-अवसर प्रदान गरेकोमा म यस ने.भौ.स.को का.का.स.का. सम्पूर्ण सदस्यज्यूहरूलाई हार्दिक धन्यवाद ज्ञापन गर्दछु । साथै यस कार्यशाला गोष्ठि आयोजक समितिका म लगायत सबै सदस्यहरूको तर्फबाट यहाँ उपस्थित सम्पूर्ण आदरणीय आमन्त्रित अतिथिहरू, ने.भौ.स.का सदस्यहरू तथा सहभागी महातुभावहरूलाई हार्दिक स्वागत गर्दै त्यागो अभिवादन टर्क्याउँदछु ।

ने.भौ.स.को २२ वर्षे नामो अवधिमा यसले विभिन्न समयमा विभिन्न स्तरका राष्ट्रिय तथा अन्तर्राष्ट्रिय सेमिनार, सम्मेलन, जियोलाजिकल कांग्रेस, कार्यशाला गोष्ठि एवं जियो साइन्टिफिक टर्क प्रोक्षामहरूको सफल आयोजना गरि धेरै अनुभवहरू संग्रहित गरेको छ । यस प्रकारका कार्यक्रमहरू आयोजना गर्ने क्रममा यस ने.भौ.स.ले वि.सं. २०१६ आश्विन ११ देखि १३ (Sept. 28-30, 1999) मा खगोलीय श्री ५ महाराजजिउराज विरेन्द्र वीर विक्रम शाहदेव सरकारको प्रमुख आतिथ्यमा "International Symposium on Engineering Geology, Hydrogeology, Natural Disaster with Emphasis on Asia" विषयमा ३ दिने अन्तर्राष्ट्रिय सम्मेलन विरेन्द्र अन्तर्राष्ट्रिय सम्मेलन भवनको सभाकक्षमा सरकारका वाहुनिबाट समुद्घाटन भई सफलता पूर्वक सम्पन्न भएको थियो भने Nepal Geological Congress पहिलो, दोस्रो र तेस्रो, नवौं Himalaya Karakoram Tibet International workshop (9th HKT) र सन् 1990 देखि 1999 सम्म UN को आस्थातमा International Decade for Natural Disaster Reduction (IDNDR) Day को बारेमा हरेक वर्ष 10 वर्षे सम्म उक्त विषयमा एक दिने सेमिनार एवं कार्यशाला गोष्ठिको सफलतापूर्वक आयोजना गरेको र UNDP/Nepal को सहयोगमा Comprehensive Database on Natural Disaster Management Capabilities in Nepal विषयमा एक प्रतिवेदन तयार गरिएको थियो । यगरी भू-विज्ञानको क्षेत्रबाट प्राकृतिक प्रकोप न्यूनीकरण बारे संवेदाधारण जनतासम्म जानकारी एवं ज्ञान (Awareness) पुर्‍याउन सकेकोमा कदर स्वरूप UN Sasakawa Disaster Prevention Award बाट "1998 Meritorus Certificate Of Disaster Prevention" प्राप्त गर्ने यो समाज सफल भएकोले यस समाजको राष्ट्रिय तथा अन्तर्राष्ट्रिय स्तरमा प्रतिष्ठा बढेको छ ।

यस ने.भौ.स.ले प्राथमिकताका साथ आफ्ना प्रकाशनहरू Journal of Nepal Geological Society र NGS News Bulletin को नियमित प्रकाशन गर्दै आएको छ जसको circulation विभिन्न राष्ट्रहरू जस्तै USA, Canada, UK, France, Germany, Austria, Switzerland, Italy, Spain, Russia, Japan, Thailand, China, Australia, Newland / SAARC देशहरूमा हुने गरेको छ ।

यस समाजले आफ्ना Publication र Exchange program अन्तर्गत विभिन्न संस्था एवं Universities को Literature (Publication) हरसंग आदान प्रदान गरि सानै रूपमा भए पनि Geoscience library संचालित गर्दै आएको छ ।

श्रीमान सभापति ज्यू तथा माननीय प्रमुख अतिथि महोदय,

नेपाली भू-वैज्ञानिकहरूले राष्ट्रिय विकासमा योगदान पुर्याउँदै आएको कुरा हाम्रा भूगर्भविदहरू भर्षाङ्गरी, कुलेखानी, कात्ती गण्डकी, गौरी, खिन्ति जस्ता जन विद्युत आयोजना, विभिन्न राजमार्ग एवं पुल निर्माण, खनिज अन्वेषण विकास, भूमिगत जलस्रोत विकास, प्राकृतिक प्रकोप न्यूनीकरण, शहरी क्षेत्रको भू-इन्जिनियरिङ तथा भू-वातावरणीय अध्ययन जस्ता कार्यहरूमा जुटेको कुरा सबैका सामुनै छुट्टैछन् । यसरी नै स्वदेशमा उपलब्ध खनिजहरूको अन्वेषण, खानी उत्खनन, खनिजको विकास एवं खनिजमा आधारित खनिज उद्योगहरूको प्रवर्धन एवं दिगो विकासमा हाम्रा स्वदेशी भू-वैज्ञानिकहरूलाई थप सेवा गर्ने अवसर प्रदान गर्न सकेमा खानीहरूको उपयुक्त विकास भई बढी भन्दा बढी उत्पादन गर्ने र खनिज उद्योगहरू राम्ररी संचालन हुन सक्ने भई श्री ५ को सरकारको राजस्वमा पनि उल्लेखनिय बृद्धि हुन फुरामा दुइभन नहोला ।

यि सबै कुराहरूलाई मध्यनजर गरि ने.भौ.स. ले खानि.भू.वि. को सहयोगमा यो एक दिने कार्यशाला गोष्ठि काठमाडौंमा आयोजना गरि एको हो । यस गोष्ठिको मुख्य उद्देश्य भूगर्भ विज्ञान बारे नेपालमा दिइने शिक्षा, उक्त शिक्षण संस्थाहरूबाट डिग्री हासिल गरि श्री ५ को सरकार का विभिन्न निकाय, प्राइभेट फर्महरू तथा खानी एवं खनिज उद्योगहरू, खनिज अन्वेषण, खानी उत्खनन, खनिज उद्योग स्थापना एवं संचालनकार्यमा कार्यरत व्यवसायिक (प्रोफेशनल) भूवैज्ञानिकहरू, इन्जिनियरहरू, व्यवस्थापकहरू, र खनिज उद्योगमा लगानि कर्ताहरू तथा लगानि गर्ने उत्सुक व्यक्ति तथा फर्महरूलाई समेत एकै थलोमा भेला गराई आफूले प्राप्त गरेको ज्ञान सीप तथा अनुभवहरूको आदानप्रदान गर्ने एवं खानी तथा खनिज उद्योग संचालनमा देखा परेका समस्या, काम, कमजोरी, कठिनाई एवं श्री ५ को सरकारको मीजुदा नीति, नीयमहरूले खनिजमा आधारित उद्योगहरू स्थापना गर्नमा लगानि कर्तालाई आकर्षण गर्न त्यति तमबन्तुका कारण र सो कठिनाई हटाउन कस्ती सहयोग भएमा खनिज उद्योगहरू फस्टाउन सक्दछन् र संचालित र हेका खानी तथा खनिज उद्योगहरू पनि किन पुर्ण रूपमा चल्न सकेका छैनन् र त्यसमा के कस्ता सुधारहरू गर्नु आवश्यक छ भन्ने बारे छलफल गराई समाधान खोज्ने हेतुले यो कार्यशाला गोष्ठिको आयोजना गरिएको हो ।

यस कार्यशाला गोठिमा जम्मा ५ कार्यपत्रहरू प्रस्तुत गरिने छन् । हरेक कार्यपत्रको प्रस्तुति पछि त्यसमा टिप्पणीकर्ताबाट टिप्पणी हुनेछ र तत्पश्चात् त्यसमा वृत्त छलफल गरिने कार्यक्रम रहेको छ । यहाँहरूले उक्त छलफलमा सक्रिय भाग लिनुभै महत्त्वपूर्ण सुझावहरू प्रदान गरी सहयोग पुऱ्याउनु भएमा केहि हद सम्म भएपनि यस क्षेत्रमा हाल विद्यमान समस्याहरू मुलकाउन मद्दत पुग्ने छ भन्ने आशा हामीले राखेका छौं भने यस कार्यशाला गोठिबाट सकारात्मक परिणाम निस्कने छ भन्नेमा हामी विश्वस्त छौं ।

हाल सम्म खा.त.भु.वि. तथा अन्य निकायहरूले नेपालमा भौगर्भिक अध्ययन, अनुसन्धान, खनिज अन्वेषण र खनिज उद्योगको विकासका लागि गरिएका प्रयास र विविधता संचालन गरिने यस प्रकारका

अन्वेषणात्मक कार्यहरूबाट थुप्रै खानीहरूका भण्डारहरू पत्ता लाग्न गई देशमा खनिज उद्योग विकासका लागि थप लगानीका अवसर प्राप्त हुने छन् भने खनिज उद्योगहरूको स्थापना गर्ने लगानीकर्ताहरू पनि आकर्षक हुनेछन् र देशमा खानी तथा खनिज उद्योगहरू फस्टाउनुका साथै पूर्णरूपमा संचालन भई राष्ट्रिय अर्थतन्त्रमा उल्लेखनिय योगदान पुग्ने कुरामा हामी विश्वस्त छौं । कार्यक्रमको चौथो तथा अन्तिम सत्र (Concluding session) मा यस अधि गरिने छलफलबाट निस्किएका निष्कर्ष मध्ये सम्बन्धित वृद्धाहरूलाई वृद्धागत हिसाबले सुझाव (Recommendation) को रूपमा लिई उक्त सुझावहरू (Recommendation) लाई सम्बन्धित निकायहरूमा पुऱ्याउने व्यवस्था गरिने कार्यक्रम रहेको छ ।

अन्त्यवाद ॥

### Speech by Hon. Dr. Shanker Sharma, Member, National Planning Commission (प्रमुख अतिथि माननीय डा. शंकर शर्माज्यूको उद्घाटन भाषण)

यस समारोहका सभापति एवं उद्योग, वाणिज्य तथा आपूर्ति मन्त्रालयका सचिवज्यू, खानी तथा भूगर्भ विभागका महासिद्देशक श्री तन्दराम स्वर्नामज्यू, नेपाल भौगर्भिक समाजका अध्यक्ष श्री प्रताप सिंह तानेज्यू, यस कार्यशाला गोठि आयोजक समितिका कर्मिन्तर श्री कृष्ण प्रसाद काफ्लेज्यू, तथा उपस्थित सम्पूर्ण सहभागी अतिथि महानुभाव एवं यस समाजका सदस्यज्यूहरू,

सबैप्रथम म यस नेपाल भौगर्भिक समाजले खानी तथा भूगर्भ विभागको सहयोगमा नेपालमा रहेका खनिज सम्पदाहरूको सर्भेक्षण, अनुसन्धान, मुल्यांकन, खानी उत्खनन, खानीज उद्योग प्रवर्धन तथा उद्योग स्थापना एवं सन्चालन कार्यसँग सम्बन्धित भू गम्भीर, माईनिङ्ग इन्जिनियर, खानीज उद्योग, खानीज उद्योगमा लगानीकर्ता एवं लगानी गर्ने चाहने व्यक्ति विशेष तथा फर्महरूलाई एकै स्थानमा भेलाभराई आफ्ना ज्ञान, सीप, अनुभव बाड्ने र हाल खानी तथा खनिज उद्योग सन्चालनमा देखापर्ने कठिनाई, काम, कम्जोरी बारे र थप खानीज उद्योगमा लगानिका अवसर भएता पनि लगानिकर्ताहरू त्यति आकर्षण हुन नसकिरहेका अवस्थामा श्री ५ को सरकारको हालको नीति नियममा के कस्तो हेरफेर तथा सुधार गर्ने आवश्यक छ भन्ने सम्मि विषयमा सम्बन्धित निकायका प्रतिनिधिहरू बिच विस्तृत छलफल गराउने उद्देश्यले यो कार्यशाला गोठिको आयोजना गरेकोमा मलाई धेरैै खुशी लागेको छ । म आशा राख्छु कि यस विचार गोठिबाट निस्किएन रूपमा केहि ठोस उपलब्धि मुलक निष्कर्ष निस्कनेछ ।

श्री ५ को सरकारले नेपालमा भौगर्भिक अध्ययन, अनुसन्धान, अन्वेषणकार्यलाई प्राथमिकता दिइ हरेक वर्ष यस सम्बन्धी कार्यक्रमहरू सन्चालन गर्दै आएको भएता पनि थपिदी माथामा बजेट र अन्य आधुनिक उपकरणहरू प्राप्त माथामा उपलब्ध गराउन नसकदा चाहिँनस्रो उपलब्धि हासिल हुन सकेको छैन । तर पनि विगतमा खानी तथा भूगर्भ विभागले गरेको अध्ययन, अनुसन्धान एवं खनिज अन्वेषणबाट पत्ता लगाईएका खानीहरूको आधारमा देशमा केहि सम्झौता तथा साना सिमेन्ट उद्योग स्थापना गरि सिमेन्ट उत्पादन बाट देशको आन्तरिक मागको करिब ४०

प्रतिशत माग पुरा गर्दै आएको छ भने केहि उद्योग प्रवर्धन एवं स्थापनाका काममा छन् । समयमा खरिददुइकाको मर्मतमाइत उद्योगले उत्पादन गर्ने नसक्दा र वर्षेन हिमाल जस्तो अति चिकट स्थानमा रहेको जस्ता, शिमा खानीको भण्डार बानी हुनका साथै हाल अन्तर्राष्ट्रिय बजारमा यसको भाउ खस्कन गएकोले आजको प्रतिस्पर्धात्मक अन्तर्राष्ट्रिय बजार व्यवस्थामा हाम्रो उत्पादनहरू आज नसक्दा लगानी गरेपनि हामीले उक्त उद्योगहरू राष्ट्रि चलाउन सकेका छैनौं भने काठमाण्डौको प्राकृतिक ग्यासको भण्डार बाट व्यवसायिक उत्पादन गर्ने लगानि कर्ताको अभावमा अझै उद्योग स्थापना हुन सकेको छैन । त्यस्तै गरि हाप्पा खनिज अन्वेषणका प्रयासहरूपनि हालसम्म साना तिना बाहेक खानी ठूला धातु खनिज भन्दार पत्ता लगाउन सफल भएका छैनन् । हाल देशमा धातु, अधातु, र पेट्रोलियम अन्वेषण गर्ने काम जारी नै छ । गोदावरी मार्बल उद्योग, कुपि चून उद्योग र साना तिना कोइला, खार, माटो, नून, दुइगा, बालुवा, गिट्टी अदिका खानीहरू र केहि अर्धकर्माल पाथरका खानीहरू संचालनमा छन् जसबाट देशको र जखममा केहि मद्दत पुर्दै आएको छ ।

आशा गरौं जाउदा दिनहरूमा खानी तथा भूगर्भ विभाग र हाप्पा भूवैज्ञानिकहरू आफ्नो कडा परिश्रम एवं मेहनतबाट थप खानीज भण्डार हरू पत्ता लगाउन सफल हुनेछन् र खनिज उद्योगहरूले पनि खानी एवं खनिजजन्य उद्योगहरूमा लगानिगार खनिज उद्योग विकासगर्नुका साथै रोजगारीका अवसरहरू प्रदान गरी राशीज निवासरणकार्यमा केहिहदसम्म भएपनि मद्दत पुऱ्याउनु र देशको आर्थिक विकासमा भरपर्दो टेवा सेवा पुऱ्याउन सफल हुनेछन् ।

नेपाल भौगर्भिक समाजले गत वर्षहरूमा सन्चालन गर्दै आएका कतिपय क्रियाकलापहरू जस्तै राष्ट्रिय, अन्तर्राष्ट्रिय स्तरको सम्मेलन, सेमिनारको सफल आयोजना तथा नेपाल हिमालय र यहाँ पाइने प्राकृतिक धोतहरूवारे भौगर्भिक अध्ययन, अनुसन्धान सम्बन्धी केही खोजमूलक लेखहरू अन्तर्र राष्ट्रिय स्तरको Journal of Nepal Geological Society एवं Bulletin को माध्यम बाट लगातार प्रकाशन गरी स्वदेश तथा विदेशमा समेत हाथी देशको भू-वनौट, प्राकृतिक सम्पदा आदि बारे स्वदेश तथा



विदेशहरूलाई जानकारी गराउन सफल हुदै आएकोमा म यस नेपाल भौगोलिक समाजलाई बधाई दिन चाहान्छु । भविष्यमा पनि यसले उत्तर उत्तर प्रगति गर्दै जाओस् भन्ने शुभकामना व्यक्त गर्दछु । जसरी यसले आज खानी तथा भूगर्भ विभागको सहयोगमा यो महत्वपूर्ण कार्यशालागोठिाको आयोजना गरेको छ त्यसरीनै आउदा दिनहरूमा पनि अन्य स्वदेश तथा विदेश सम्बाहकसंग सहयोगिताई नेपालको जलश्रोत विकास, पूर्वाधार विकास, भू उपयोग एवं प्राकृतिक प्रकोप न्युनिकरण तथा वातावरण संरक्षण जति विषयहरूलाई पनि महत्व दिइ देशको प्राथमिकतालाई विचार गरी यसप्रकारका कार्यक्रमहरू आयोजना गरी सर्वसाधारणलाई यि विषयहरूमा जानकारी गराउने र अन्य देशका भू वैज्ञानिकहरूसँग हाम्रा भू वैज्ञानिकहरूको ज्ञान, सिप, अनुभव एवं प्राविधि आदान प्रदान गरी कार्यक्षमता बढाउदै लैजाने प्रयास जारी राख्ने छ ।

विदेशका विश्व प्रसिद्ध भू वैज्ञानिकहरू पनि यस समाजका सदस्य छन् र यस समाजले प्रकाशन गर्ने Journal of Nepal Geological Society अन्तर्राष्ट्रिय स्तरको हुनुका साथै SAARC देशहरू, चीन, थाइलैण्ड र पुराण, अमेरिकाका धेरै देशहरू र अष्ट्रेलिया, जापान जस्ता अन्य विकसित देशहरूका प्रसिद्ध पुस्तकालयहरूमा समेत यिनले राम्रो स्थान पाइसकेका छन् भन्ने सुन्दा मलाई धेरै खुशी लागेको छ । यसले आफ्ना प्रकाशनहरू अन्य देशका भू विज्ञान सम्बन्धि प्रकाशनहरूसँग exchange गरी

Geoscience Library संचालन गर्ने प्रयासले आफ्ना प्रकाशनहरू अन्य देशमा पुर्‍याउन मात्रै सफल नभई अन्य देशका Journal हरूलाई विदेशीय छुट्याउने नगरिकनै प्राप्त गर्ने तरिका अपनाएकोमा म यस कार्यको सन्तान गर्नेका साथै अन्य एस्तै Professional Society हरूले पनि यसको अनुकरण गर्ने राम्रो हुने नालाई दिन चाहान्छु । हाम्रा पश्चिमि एवं कमंड भू वैज्ञानिकहरू बाट यो देशले धेरै ज्ञान राखेको छ । हामी सवैले आफ्नो बुद्धि, विवेक, ज्ञान, सिप र मिहनत लगाएर काम गर्दै गएमा हामी यो सानो सुन्दर, प्राकृतिक श्रोतले भरिपूर्ण हिमाली अधिराज्य एक दिन अवश्य पनि आफ्ना प्राकृतिक श्रोतहरूको धेरै भन्दा धेरै परिचालन एवं सदुपयोग गरी एक विकसित राष्ट्रको दाजीमा उत्रन सफल हुनेछ ।

अन्तमा मलाई यस नेपाल भौगोलिक समाजले खानी तथा भूगर्भ विभागको सहयोगमा आयोजना गरेको यो नेपालमा खानी सम्पदाको विकास, खानी उद्योग प्रवर्धन तथा स्थापनामा भू विज्ञानको भूमिका विषयक एक दिने कार्यशाला गोठिमा प्रमुख अतिथि भई गोठिाको समुद्घाटन गर्ने र आफ्नो मनमा लागेका केहि कुराहरू व्यक्त गर्ने अवसर प्रदान गर्नु भएकोमा आयोजक नेपाल भौगोलिक समाज तथा सह आयोजक खानी तथा भूगर्भ विभाग र आयोजक कर्मिटीका सम्पूर्ण सदस्यहरूलाई धन्यवाद व्यक्त गर्न चाहान्छु ।

धन्यवाद ॥

Speech by Mr. Ram Krishna Pant, Acting Secretary, Ministry of Industry, Commerce and Supplies

(कार्यशाला गोठि उद्घाटन समारोहका सभापति श्री राम कृष्ण पन्तज्यूको मन्तव्य)

प्रमुख अतिथि एवं राष्ट्रिय योजना आयोगका माननीय सदस्य डा.शंकर शर्मा ज्यू,

खानी तथा भूगर्भ विभागका महानिदेशक, श्री तन्दराम स्वापित ज्यू,  
नेपाल भौगोलिक समाजका अध्यक्ष श्री प्रताप सिंह ताम्ते ज्यू,  
यस कार्यशाला गोठि आयोजक समितिका कतिपय श्री कृष्ण प्रसाद काफ्लेज्यू,  
सम्पूर्ण उपस्थित सहभागी व्यक्तित्वहरू,

महोदयहरू,

सबप्रथम म यस नेपाल भौगोलिक समाजले खानी तथा भूगर्भ विभागको सहयोगमा आयोजना गरेको "नेपालमा खनिज सम्पदाको विकास, खनिज उद्योग प्रवर्धन तथा स्थापनामा भू-विज्ञानको भूमिका" विषयक ५ दिने यो कार्यशाला गोठिमा मलाई आमन्त्रण गरी यस उद्घाटन समारोहको सभापतिको आसन ग्रहण गर्ने मौका प्रदान गर्नु भएकोमा यस कार्यशाला गोठिका आयोजक नेपाल भौगोलिक समाज एवं सहयोगी खानी तथा भूगर्भ विभाग लाई धन्यवाद दिन चाहान्छु ।

नेपाल एक भू-परिरेमिट, प्राकृतिक सम्पदाहरूको धनि, हिमाली क्षेत्रमा अवस्थित एक पहाडी मुलुक हो । यत्र रहेका खनिज सम्पदाहरूको समेक्षण अध्ययन, अनुसन्धान, मुल्याङ्कन, खनिज उद्योग प्रवर्धन गर्ने काम खानि तथा भूगर्भ विभागले यसको स्थापना काल देखिनै गर्दै आएको छ । हाल सम्म यस विभागले अधिराज्यका विभिन्न स्थानहरूमा भू-वैज्ञानिक अध्ययन, अनुसन्धान तथा अन्वेषण गरि कतिपय धातु, जस्ता, निमोषामुखी तथा उर्जाजन्य खनिजहरू पत्ता लगाउन सक्षम भएको छ भने कतिपय अझ पनि अन्वेषणकै क्रममा छन् । हाल सम्मका अध्ययनबाट नेपाल अधिराज्यमा जे जति खनिज भण्डारहरू

पत्ता लागेका छन् तिनीहरू मध्ये केहि खानी संचालन एवं उद्योग स्थापना भई संचालनमा आएका छन् भने केहि उत्खनन् तथा औद्योगिकरण गर्न आर्थिक दृष्टिले लाभप्रद देखिए पनि तिनको समुचित विकास भई सदुपयोग हुन नसकेको प्थार्थता हाम्रा सामु छुईछ । कतिपय संचालित खानी तथा खनिज उद्योगहरू पनि विभिन्न कारणले पूर्ण रूपमा संचालन हुन सकेका छैनन् ।

देशमा घटि रहेका विभिन्न घटनाले अधिराज्यका विभिन्न स्थानमा संचालन गरिदै आएका भौगोलिक अध्ययन, अनुसन्धान, खनिज अन्वेषण कार्य, खनिज उद्योग विकास, संचालित खानी एवं खनिज उद्योगहरू समेत नराम्ररी प्रभावित भएका छन् । यस सन्दर्भमा नेपाल भौगोलिक समाजले खानी तथा भूगर्भ विभागको सहयोगमा "नेपालमा खनिज सम्पदाको विकास, खनिज उद्योग प्रवर्धन तथा स्थापनामा भू-विज्ञानको भूमिका" विषयमा यो कार्यशाला गोठिाको आयोजना गरि भू-विज्ञान संग सम्बन्धित विज्ञहरू, खनिज अन्वेषण उत्खननमा सम्लग्न निकायका प्रतिनिधिहरू एवं खनिजमा आधारित उद्योगहरूमा सम्लग्न उद्यमिहरू एवं लगानीकर्ताहरू समेतलाई एकै थलोमा राखि खनिज उद्योग विकासमा आफ्नो विचारहरू आदान प्रदान र बहत छलफल गरी महत्वपूर्ण सुझावहरू दिन र नेपाल अधिराज्यमा रहेका खनिज सम्पदा एवं खानी र खनिज उद्योगहरूको बारेमा सवैलाई जानकारी दिलाउनका साथै हाल खनिज अन्वेषण, खानी उत्खनन एवं खनिज उद्योग संचालनमा देखा परेका कति कमजोरी, समस्या तथा अड्यारहरू बारे आफ्ना आफ्ना तर्फबाट सुझावहरू दिई समस्या समाधानका उपायहरू पत्ता लगाई सम्बन्धित निकायहरूमा पठाउने उद्देश्यले आयोजना गरिएको गोठि अल्पकाल समयमाथिक र सञ्चालित छ ।



मसाला पुर्ण विश्वास छ तपाईंहरु बिच हुने अन्तर्क्रिया, छलफल वाट कतिपय बिषयमा थप ज्ञान र सीपको आदान प्रदान हुनेछ र यस कार्यशाला गोष्ठि वाट निस्कने निबोध एवं recommendation हरु हामीलाई प्राप्त हुने नै छ । श्री ५ को सरकारले खानी तथा खनिज उद्योग विकास एवं संचालनमा देखापर्नेका काम कमजोरी एवं कठिनाईहरुलाई बिचार गरी आउदा दिनहरुमा संचालित खानीहरुलाई स्वस्थित गर्ने, खनिज उद्योगहरुमा लगानि गर्ने इच्छुक लगानिकर्ताहरुलाई आकर्षण गर्ने आवश्यक पर्ने नीति, नीयमहरुलाई सम्बन्धमाथिक वगाउँदै लैजात पढल गर्ने नै छ ।

आशा छ बसरी नै नेपाल भौगर्भिक समाजले भविष्यमा पनि यस प्रकारको कार्यशाला गोष्ठि एवं सेमिनारहरु आयोजना गरेर नेपालको भौगर्भिक अवस्था, यहाँ प्राप्त हुन सक्ने खनिज स्रोत र तिनको उपयोग

एवं विकास बारे जानकारी गराउँदै जाने छ । हामीलाई विश्वास छ आउदा दिनहरुमा हाम्रा भू-वैज्ञानिकहरुले देश विकासको काममा अधिराज्यको विभिन्न छान्डहरुमा भू-वैज्ञानिक अध्ययन, अनुसन्धान, खनिज अन्वेषण तथा विकास आयोजनाहरुमा आफ्नो परिश्रम, सिप र ज्ञानलाई धेरै भन्दा धेरै उपयोग गरी देशको विभिन्न स्थानमा थुप्रै खानीहरु पत्ता लगाउन सक्षम हुने छन् र ती खानीहरुमा हाम्रा उद्यमीहरुले खनिज उत्खनन एवं खनिज जन्म उद्योगमा लगानी गरि स्वदेशमा उपलब्ध खनिजहरुको समुचित सदुपयोग एवं विकास गरि आन्तरिक बाग पुर्न गर्नका साथै निर्यात गर्न समेत सफल भई देशको आर्थिक स्थितिमा अभिवृद्धि गर्न सहयोग पुऱ्याउने छन् । यसका लागि तपाईं हामी सबैको अधिक प्रयास जारी हुन अनिवार्य छ ।

धन्यवाद ॥

### Speech by Mr. N.R. Sthapit, Director General, Department of Mines and Geology (खानी तथा भूगर्भ विभागका महानिर्देशक श्री नन्दराम स्थापितले दिनु भएको मन्तव्य)

आदरणीय सम्भाषित ज्यू,

प्रमुख अतिथि राष्ट्रिय योजना आयोगका माननीय सदस्य डा. शंकर शर्माज्यू,

नेपाल भौगर्भिक समाजका अध्यक्ष श्री प्रताप सिंह तानेड ज्यू,  
यस कार्यशाला गोष्ठिका क्रिस्मिन् श्री कृष्ण प्रसाद काफ्लेज्यू,  
विभिन्न संघ संस्थाबाट प्रतिनिधित्व गर्नुहुने महानुभावहरु  
तथा उपस्थित सम्पूर्ण सहभागी मित्रहरु

नेपालको खनिज सम्पदा, यसको विकास र प्रवर्द्धन बारे सम्बन्धित क्षेत्रका विशेषज्ञहरु, खनिज क्षेत्रमा लागेका उद्यमीहरु र सम्भाव्य लगानीकर्ताहरु बीच अन्तरक्रिया गर्ने एउटा कार्यशालाको आयोजना गर्न खानी तथा भूगर्भ विभागले लामो समयदेखि प्रयास गरिरहेको र आज नेपाल भौगर्भिक समाजको सक्रियतामा यी मौका पाउँदा मलाई ज्यादै खुशी लागेको छ । खानी तथा भूगर्भ विभागको उद्देश्यहरु मध्ये खनिज स्रोतको पहिचान, अन्वेषण एवं मूल्याङ्कन गरी उद्योग प्रवर्द्धन गर्ने तथा यसको पुर्वाधारको विकास गर्नु पनि हो । विभागले आफ्नो स्थापनाकाल देखिनै खनिज अन्वेषण अध्ययन तथा अनुसन्धान कार्यलाई विशेष प्राथमिकता दिँदै आएको छ । यसको परिणाम स्वरूप अधिराज्यका केयन स्थानहरुमा धातु तथा अधातु खनिजका भण्डारहरु पहिचान भई सकेका छन् । हालसम्म विस्तृत अन्वेषण तथा मूल्याङ्कन भएका धातु खनिजमा मुख्यतया तामा, बिस्मा, जस्ता, फलाम आदि पर्दछन् । यिनीहरुको परिमाण सानो भएको र न्यून गुणस्तर भएका कारण वर्तमान परिप्रेक्ष्यमा यिनीहरुको उत्खनन तथा प्रशोधन खर्च महँगो पर्ने हुँदा हाल उत्खनन हुन नसकेको स्थिति रहेको छ । तर पनि भौतिक पुर्वाधारको अवस्था, अन्तराष्ट्रिय बजार तथा प्राविधिक विकास आदिको आधारमा भविष्यमा यिनीहरुको पुनः मूल्याङ्कन गर्दै सानु बान्छनीय हुन जानेछ ।

हाल सम्म सम्पन्न भएका एकीकृत खनिज अन्वेषण, अनुसन्धानबाट अझातु खनिज नै मुलुकको निविधन एवं भरपर्दो खनिज स्रोत भएको पुष्टि भएको छ । प्राप्त नतीजा अनुसार आर्थिक दृष्टिले लाभप्रद हुन सक्ने पाइएका अझातु खनिजमा चुनदुइ, म्याग्नेसाइट, डोलोमाइट, खरी, कोइला,

प्राकृतिक ग्याँस, किमती तथा अर्ध किमती पत्थर, निर्माणमुखी खनिज आदि पर्दछन् ।

खानी तथा खनिज पदार्थ ऐन, २०४२ तथा नियमावली, २०४६ लागू भएपछि हाल संचालित खनिजहरुबाट खनिजको गुणस्तर, वर्ग, प्रकृति र उत्पादनको आधारमा पहिलेको दाजोमा उल्लेखनीय राजस्व वृद्धि भई अस्सी लाख ०१५०१८ मा रु. करिब ४२ लाख र आ.व. २०१८/०१९ मा खनिज क्षेत्रको योगदान करिब २ अरब रहेको पाइएको छ भने राष्ट्रिय अर्थतन्त्रमा खनिज क्षेत्रको ०.४४ देखि ०.६४ सम्म योगदान पुगेको छ र गर्न २८ वर्षको अकड्डा लाई हेर्ने हो भने श्री ५ को सरकारको लगानीको तुलनामा केयन मुणा प्रतिफल प्राप्त भएको छ र साथै यस क्षेत्रले केयनलाई प्रत्यक्ष तथा अप्रत्यक्ष रुपमा रोजगारी प्रदान गर्न सफल भएको छ । खानी तथा खनिज पदार्थ नियमावली कार्यान्वयनको सिर्जिततामा हालसम्म भए गरेका कामहरुको अनुभवबाट देखा परेको समस्या, कठिनाई, बाधा अड्कन तथा कमिकमजोरीहरुको मूल्याङ्कन गरी समस्यापेस सुधार गर्दै लैजाने उद्देश्य अनुरूप नियमावलीको संशोधनको लागि मस्यौदा तयार भई कारवाहीको अवस्थामा रहेको छ ।

अझातु खनिज मध्ये सबैभन्दा महत्वपूर्ण मानिएको लाइम स्टोन अथवा सिमेन्ट बनाउन उपयुक्त चुनदुइ नेपाल अधिराज्यभर प्रचुर मात्रामा पाइएको छ । केही स्थानहरुमा विस्तृत सर्बेक्षणबाट परिमाण तथा गुणस्तर प्रमाणित भई उद्योग स्थापनाकालागि प्रस्ताव आह्वान भएकोमा हाल प्रस्ताव मूल्याङ्कनको कार्य भैरहेको छ भने अन्य स्थानहरु घरघरवट अन्वेषणको कार्य भैरहेको छ । उदाहरण स्वरूप सुर्खेत स्थित चौकुने र सल्यानको कजेरी चुनदुइको प्रस्ताव आह्वान गरी मूल्याङ्कनको कार्य भईरहेको छ भने धनकुटा निगालेको चुनदुइमा आधारित सिमेन्ट उद्योग स्थापनापि प्रस्ताव आह्वान गरिएको छ ।

त्यस्तै काठमाडौं उपत्यकाको प्राकृतिक ग्याँसको निजी लगानीकर्ताबाट प्रस्ताव आह्वान गरी आर्थिक एवं प्राविधिक मूल्याङ्कनको कार्य सम्पन्न भई उद्योग स्थापनापि एउटा नेपाली कम्पनीको छलीट भई सकेको र हाल उक्त कम्पनिसँग छलफल भैरहेको छ । वास्तवमा खनिज स्रोतको उपयुक्त

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तसर्थ, खनिज श्रोतलाई समयमै विकास गरी उद्योगमा परिणत गरी उत्पादनमा ल्याउन सकिने भन्ने आर्थिक विकासमा राष्ट्र धेरै पछि पर्ने सक्छ । यस परिप्रेक्षमा हेर्दा यो कार्यशालाको उद्देश्य ज्यादै समसामयिक र सान्दर्भिक छ । तत्काल र आगामी दिनहरूमा खनिज क्षेत्रमा लगानी गर्ने कम्ता अवसरहरू उपलब्ध हुन सक्छन् । कसरी देशको खनिज सम्पदाको अधिकतम उपयोग गरी देशको कुल गृहस्थ उत्पादनमा यसको योगदान अभिवृद्धि गर्न सकिन्छ । यस क्षेत्रमा निजी

लगानीकर्ताहरूलाई कसरी बढी भन्दा बढी सहभागी बनाउन सकिन्छ । खनिज उद्योगले हाल के कस्ता समस्याहरू भोग्नु परिरहेको छ । यी सबै महत्वपूर्ण विषय वस्तु उपर यस गोष्ठीमा खनिज विशेषज्ञहरू, लगानीकर्ताहरू र उद्यमीहरू बीच विस्तृत छलफल भई ठोस दिशानिर्देश गर्ने कार्यशाला सफल हुनेछ र लगानीको बातावरण अझै बढी उपयुक्त तथा आकर्षक बनाउन सहयोग सिद्ध हुने छ भन्ने आशा एवं विश्वास लिएको छु ।

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## ABSTRACT OF THE PAPERS PRESENTED IN THE WORKSHOP

### Geoscience education in professional manpower development in Nepal

(नेपालमा पेशागत जनशक्ति विकासमा भू-विज्ञान शिक्षा)

डा. प्रकाश चन्द अधिकारी,  
केन्द्रिय भूगर्भ विभाग, विभुवन विश्वविद्यालय

खनिज विज्ञान प्रविधिको भूवैज्ञानिक औपचारिक अध्यापन नेपालमा सन् १९६७ मा शुरू भएको हो। राष्ट्रमा उपलब्ध थोत मात्र घाट पनि योजना गरिएको पाठ्यक्रम राष्ट्रिय आवश्यकता अनुरूप माग पूरा गर्ने सामान्यतया वि. वि. वि. सफल भएको भान्नु पर्छ। खनिज जन्तु उद्योग नेपालमा ज्ञानसम्पन्न पनि दुरी रूपमा उभिन नसकेको अवस्थामा खनिज उद्योगको आवश्यकता सामान्यतया आधारभूत ज्ञान र प्रविधि हस्तान्तरण मात्रमा निर्मित रहेको छ। वि. वि. वि. अन्तर्गत स्थापित भू-विज्ञानको शिक्षाले राष्ट्रलाई आवश्यक मात्रामा भू-वैज्ञानिक, खनिज विज्ञान प्रविधि र प्राविधिकहरू (भूगर्भविद) उत्पादन गर्न सफल भएको छ। हाल नेपालमा कार्यरत भू-वैज्ञानिकहरू मध्ये धेरै जसो भूगर्भविदहरू वि. वि. वि. संग सम्बन्धित छन्। भूविज्ञानमा औपचारिक अध्यापन कार्यक्रमले राष्ट्रिय खनिज उद्योगलाई आवश्यक पर्ने प्राविधिकहरू उपलब्ध गराउन पुर्णतया सफल रहेको भान्नु पर्दछ। तर देशमा आवश्यक खनिजजन्य आर्थिक क्रियाकलापको अभावमा यो शिक्षाको एभेरोरो विकास सम्भव नहुने व्यापक अनुभव भएको छ। खनिज विज्ञान प्रविधिको राष्ट्रियस्तरमा विकास र उपयुक्त प्रविधि हस्तान्तरणको चरण राष्ट्रिय खनिज विज्ञान प्रविधि शिक्षण प्रविधिमा पनि निर्भर रहन्छ।

सरकारी क्षेत्रमा खानी विभागको स्थापना सन् १९६१ मा भए पछि मात्र खनिज अन्वेषण, उत्खनन र प्रचर्जनको ध्यानमा आएको हो। प्रागुज्ज्वल कट्टर उद्योग लगभग समाप्त हुन लागेको अवस्थामा राष्ट्रलाई आवश्यक भौगर्भिक अन्वेषण र खनिज अन्वेषण कार्यका लागि आवश्यक पर्ने जनशक्ति उत्पादनमा वि. वि. वि. को भूमिका सदैव सर्वोपरि रहेको छ। भौगर्भिक सर्वेक्षण र अनुसन्धान, खनिज अन्वेषण कार्यहरूकासाथै विज्ञान प्रविधि, निर्माण सामग्री, जलस्रोत र उर्जा विकास एवं उत्पादन क्षेत्रमा समेत कार्यक्षेत्र विस्तार भएको अवस्थामा वि. वि. वि. को पाठ्यक्रममा समावेश गर्न गरिएको छ।

विस्तारै विस्तारै भूविज्ञान पनि भौतिक तथा रसायन विज्ञानका साथै सूचना प्रविधि समेतलाई प्रयोग गरेर समय सापेक्ष हुदै गएको छ। दूर

संचेदन र भूभौतिकीय प्रविधिहरूले खनिजजन्य र अन्य उद्योगहरूलाई पहिले कल्पना पनि गर्न नसकिने गणितीय समाधानहरू प्रदान गर्ने सम्बन्ध बनाईदिएको छ।

खनिज उद्योग सधैंनै सबै भन्दा ठूलो रोजगारीदाताको रूपमा सर्वत्र रहेको छ। खनिज उद्योगलाई स्वरोजगारीमूलक कट्टर उद्योगको रूपमा विकास गर्न सकेको खण्डमा धेरै राष्ट्रिय र सामाजिक समस्याहरू समाधान हुन सक्ने छन्।

उद्योगमा आवश्यक शीप र प्रविधि हस्तान्तरण अब विश्वविद्यालयहरूको एक्लो जिम्मेवारी भित्र मात्र पार्न सकिन्न। तालिम, पुनर्लाजगी, दूर शिक्षण जस्ता शिक्षण प्रणालीको विकास हुन अत्यावश्यक भएको महत्त्वपूर्ण विश्व विद्यालयले गरिसकेको छ।

यस परिप्रेक्ष्यमा खनिज विज्ञानप्रविधिको विकासलाई आवश्यक पर्ने आर्थिक दायित्वबाट खनिज उद्योगहरू भाग्न पाउँदैनन्। तर र राष्ट्रिय अर्थतन्त्रमा समावेश भएको करताई कसरी अनुसन्धान र प्रविधि विकासमा लगाउने भन्नेबारे सोध्नु आवश्यक छ। यसमा उद्योगबाट सरकार र सरकारबाट फेरि अनुसन्धान संस्थानमा जाने बाटोलाई खुला गर्नु अत्यावश्यक छ। भूमिन्डालय करणको भूमर 'मा राष्ट्रिय खनिज उद्योग पुर्णतया सम्भावना धेरै छ। यसप्रकार र राष्ट्रिय तथा अन्तर्राष्ट्रिय लगानि प्रचर्जन अब पुर्णतया खनिज विज्ञान प्रविधि हस्तान्तरण भन्दा पनि प्रविधि सामन्जस्यीकरणमा भर पर्ने हुन आउछ। यसो परिप्रेक्ष्यमा विश्वविद्यालय जस्ता पुर्णतया मोचमा रहने हो भने समाज अन्य कुनै प्रविधि लफ आर्किस्न हुने सम्भावना धेरै छ। उत्पादन मात्र नभएर उत्पादनसिलता आजको राष्ट्रिय खनिज उद्योग र खनिज विज्ञान प्रविधिकर्मको राष्ट्रिय दायित्व हुन आउँछ। राष्ट्रको धान भनेको अर्थ व्यवस्था हो जसमा खनिज एवं उर्जा उद्योग सर्वोपरि रहने गर्दछ।

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### सारांश

देशको विकट भौगोलिक अवस्था, उपयुक्त भौतिक पूर्वाधार र आवश्यक लगानीको अभावका कारण यहाँ जहाँ खनिज श्रोत छ, त्यसको उचित परिचालन हुन नसकेको छैन। यसै स्थितिबाट दृष्टिगत गरी मुलुकमा हालसम्म पत्ता लागेका खनिज श्रोतहरूको आधारमा यस क्षेत्रमा लगानिका अवसरहरू बारे केही जानकारी दिने प्रयास यस कार्यपत्रमा गरीएको छ। खानी तथा भूगर्भ विभागले लामो समयदेखि खनिज अन्वेषण कार्य गर्दै आएको फलस्वरूप अधिराज्यका विभिन्न स्थानहरूमा खनिज भण्डारहरू पत्ता लागेका छन्। धातु खनिजका भण्डारहरू जस्तै साना भएका र निम्न गुणस्तर भएका कारण उचित पूर्वाधारको अभावमा हाल प्राथमिकता पाउन नसकेका छैनन्। तर अझानु खनिज श्रोतहरू खास गरेर सिमेन्ट बनाउन उपयुक्त चुनढुंगा प्रसस्त मात्रा पाइएको र केहीको परिमाण र गुणस्तर पनि यकिन भैसकेको हुँदा उद्योग स्थापनाका लागि लगानीका अवसरहरू उपलब्ध भएका छन्। आन्तरिक मागको करिब ६०% सिमेन्ट हाल विदेशबाट आयात भैरहेको स्थिति हेर्दा नेपालमा सिमेन्ट उद्योगमा गरिने लगानी खेर नजाने कुरा स्वतः सिद्ध छ। यहाँ पाइएका आर्थिक दृष्टिले लाभप्रद हुन सक्ने अन्य खनिज श्रोतहरूमा म्याग्नेसाइट, डोलोमाइट, खरी, कोइला, प्राकृतिक ग्याँस, किमर्त तथा अधीकृमर्त पत्थर, निर्माणमूखी खनिज आदि पर्दछन्। यस कार्यपत्रमा लगानीको दृष्टिले खनिज श्रोतलाई मुख्यतः तीन वर्गमा प्रस्तुत गरिएको छ: १. विस्तृत अन्वेषणमै उद्योग स्थापनाका लागि लगानी योग्य खनिज भण्डारहरू, २. विस्तृत अन्वेषण तथा संभाव्यता अध्ययनकालागि उपलब्ध खनिज भण्डारहरू र ३. खान तलामाका लागि उपलब्ध अन्य संभावित क्षेत्रहरू। साथै खानी ऐन, नियम सम्बन्धि नीतिगत व्यवस्थाका बारेमा पनि केही जानकारी दिने प्रयास गरिएको छ।

### पृष्ठभूमि

नेपाल विविध चट्टानयुक्त पहाड/पहाडले घेरेको प्राकृतिक श्रोतपूर्ण अधिराज्य हो। यहाँको भौगोलिक विषमता र भौगर्भिक जटिलताले यहाँ विद्यमान खनिज सम्पदाको समुचित उपयोग गर्ने कार्य अझै प्रारम्भिक अवस्थामा नै रहेको छ। हुनत: राजाकायमा देशका विभिन्न स्थानमा ससाना खानीहरू संचालन भएका थिए, जसको प्रमाण ठाउँ ठाउँमा भेटिएका टोपाहरू (adits) र फालिएका किटहरू (slags) आज पनि देख्न सकिन्छ। शुरु शुरुमा ससाना खानीहरू राम्रैसँग संचालन भएका भएता पनि पछि विभिन्न प्राविधिक कारणवस उत्खनन तथा प्रशोधन खर्च जम्मा कठिन र महँगो पर्दै गएको र विस्तारै बाटोहरू निर्माण हुँदै गएको, विदेशबाट आयातित धातु सुपय मोलमा बजारमा उपलब्ध हुँदै गएको कारण राजा शासन पतन हुनु अघि नै धेरै खानीहरू बन्द भएका थिए। खानी तथा भूगर्भ विभागले सन् १९६०को दशक देखिनै चरणबद्ध रूपमा खनिज अन्वेषण कार्य गर्दै आएको हो। जसको फलस्वरूप केवल

ससाना फलाम, तामा, शिशा, जस्ता खानीहरू पत्ता लागी विस्तृत मूल्याङ्कन पनि भएको छ। तर धेरै जसो निम्न आर्थिक स्तरका (sub-economic grade) भएको र खनिज भण्डार पनि त्यति ठूलो नभएको कारण र विरल बजारमा यी धातुको मोल पनि खस्कदै गएको परिस्थितिमा आर्थिक दृष्टिले लाभप्रद हुने नदेखिएकोले हाल धातु खनिज अन्वेषण कार्य करीब स्थगन जस्तै भएको छ। फलतः भौगर्भिक कर्मी र लाभप्रद खनिज हुनसक्ने संभावनाको आधारमा विभागले अधानु खनिज जस्तै सिमेन्ट रोड चुनढुंगा, माबल, म्याग्नेसाइट, डोलोमाइट, खारजहाइट, फोस्फोराइट, खरी, कोइला, किमर्त तथा अधीकृमर्त पत्थर एवं निर्माणमूखी खनिज खोजी कार्यक्रम विशेष तदारुताका साथ संचालन गर्दै आएको छ। परिणाम स्वरूप अधिराज्यका विभिन्न ठाउँमा नयाँ खनिज श्रोतहरूको परिचालन भई यस क्षेत्रमा लगानीका अवसरहरू पनि बृद्धि भएका छन्।

विस्तृत अन्वेषणमै उद्योग स्थापनाका लागि लगानीयोग्य खनिज भण्डारहरू:

प्राथमिकताका आधारमा सतही तथा भूमिगत विस्तृत अन्वेषण (जियोलेजिकल म्यापिङ, टोपी सर्वेइङ, ट्रेन्चिङ, च्यानल म्यापिङ, ड्रिलिङ) गरी खनिज भण्डारको वस्तुगत अवस्था (भूमिगत लगान), परिमाण (reserve), गुणस्तर (grade) र उत्खनन स्थिति (mineability) यकिन भएका खनिज प्रस्पेक्टहरूमा चुनढुंगा अग्रपंक्तिमा पर्दछ। हाल देशमा भैरहेको कुल सिमेन्ट खपतको केवल ४० प्रतिशत मात्र आन्तरिक उत्पादनबाट पनि भएको अवस्थालाई दृष्टिगत गर्दा यहाँ सिमेन्ट उद्योगको भविष्य उज्ज्वल भएको विश्वास गर्न सकिन्छ। उद्योग स्थापनाका लागि उपलब्ध अन्य खनिज पदार्थहरूमा फलाम, डोलोमाइट र प्राकृतिक ग्याँस पर्दछन्।

यस वर्गका डिपोजिटहरूको परिमाण (भण्डार), पूर्वाधार स्थिति र वर्तमान अवस्था निम्नानुसार रहेको छ।

#### चौकुने चुनढुंगा, सुर्खेत:

**प्रमाणित खनिज:** ३ करोड टन सिमेन्ट बनाउन उपयुक्त चुनढुंगा, **पूर्वाधार:** सुर्खेतबाट गुट्टु सम्म घाबेल रोड, १३ कि.मि. बाटो बनाउनु पर्ने, १३२ के.मि. लाईन ५२ कि.मि. टाढा रहेको, **वर्तमान स्थिति:** १००० टन प्रति दिन सिमेन्ट उत्पादन गर्ने प्रस्ताव अहवाल गरी मूल्यांकन प्रक्रिया अन्तिम अवस्थामा रहेको।

#### नरपानी चुनढुंगा, अर्घाखाँची:

**प्रमाणित खनिज:** १.७ करोड टन, डाईनामाइट क. लि. ले २०० टन प्रति दिन क्षमताको सिमेन्ट उद्योग स्थापना गर्न निज लिएको, तर हाल सम्म केही काम नभएको, **पूर्वाधार:** घाबेल रोड पुगेको, १३२ के.मि. लाईन ४९ कि.मि. टाढा गोर्खासँगमा रहेको।

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**जर्दरी चुनडुंगा, सल्यान :**

**प्रमाणित खनिज:** २.९ करोड टन, **पूर्वाधार:** राबेल रोड १३ कि.मि. टाढा बरबसम्म, **चिजुली तजिक नभएको, वर्तमान स्थिति:** मिमेन्ट उद्योगको लागी प्रस्तावहरू प्राप्त भएकोमा मूल्याङ्कन गर्ने काम शुरु भएको।

**निगाले चुनडुंगा, धनकुटा :**

**प्रमाणित खनिज:** ६.३ लाख टन, **पूर्वाधार:** राबेल रोड ११ कि.मि. टाढा (बसन्तपुर), **वर्तमान स्थिति:** उद्योग स्थापनाका लागि प्रस्तावहरू प्राप्त भएकोमा मूल्याङ्कन गर्ने काम शुरु भएको।

**गन्धारी चुनडुंगा, दाङ :**

**प्रमाणित खनिज:** १ करोड टन, **पूर्वाधार:** क्विच मोटर वाटोबाट ७ कि.मि. टाढा, १३२ के. मि. लाईन ४० कि.मि. टाढा भएको।

**उदयपुर होतोमाईट, उदयपुर :**

**प्रमाणित खनिज:** ४८ लाख टन, **पूर्वाधार:** बाटो र चिजुली स्वतन्त्रम पुरेको।

**प्राकृतिक ग्याँस, काठमाडौँ :**

**प्रमाणित भण्डार:** ३० करोड घन मिटर, **फ्रैलाबट २६** वर्ग कि.मि., **वर्तमान स्थिति:** संभाव्यता अध्ययन पुरा भएको, व्यवसायीहरूको लागि प्रस्तापित।

**फुलचोकी फाल्गु, ललितपुर :**

**प्रमाणित खनिज:** ४० लाख टन घाट, **अर्ध प्रमाणित:** ६० लाख टन, **पूर्व संभाव्यता अध्ययनबाट** ४०,००० टन क्षमताको स्क्वज ड्राइन स्थापना गर्ने माकिने, ५० टन क्षमताको स्टिल प्लाष्ट राख्न माकिने।

दोलखाको खार्जुंगामा रहेको ६ करोड टन उच्च गुणस्तरको ग्यान्सेसाईट (प्रमाणित) मा आधारित नेपाल ओरिएन्ड ग्यान्सेसाईट प्रा. लि. स्थापना भै ४०,००० मे.टन डेढ बन्ट ग्यान्सेसाईट परीक्षण उत्पादन गर्न प्लान्ट परिक्षण स्थापना भई उत्पादन समेत गरिएको, तर प्राविधिक कारण परीक्षण उत्पादन असफल भएकोले हाल कम्पनी बन्द अवस्थामा रहेको छ। यसैगरी गल्छा हिमालमा रहेको शिशा/जस्ता खानी पनि नेपाल मेटल कम्पनी अन्तर्गत ४०० मे. टन प्रति दिन क्षमताको घाट प्रशोधन गर्ने प्लान्ट स्थापना गर्न कम्पनी स्थापना भएको तर अन्तिम १० कि.मि. बाटो हालसम्म पनि निर्माण हुन सकेको छैन। विविध कारण यस कम्पनी रुख अवस्थामा रहेको छ। दुवै उद्योगमा बप लगानी गर्नु पर्ने आवश्यकता रहेको छ।

विस्तृत अन्वेषण तथा संभाव्यता अध्ययनको लागि उपलब्ध खनिज प्रस्पेक्टहरू

प्रारम्भिक सर्भेक्षण स्तरको म्यापिङ्ग, च्यानल म्यापिङ्ग, चोप म्यापिङ्ग, रसायनिक विश्लेषण आदि बाट उत्साहजनक नतिजा प्राप्त भएका स्वतन्त्र (prospects) मा विस्तृत अन्वेषण कार्य गरी खनिजको सतही र भूमिगत अवस्था, रसायनिय गुणस्तर (grade), कुल परमाण (tonnage) आदि याँकित गरी आर्थिक तथा प्राविधिक संभाव्यता अध्ययन गर्ने जरुरी हुन्छ। यस प्रकारको अन्वेषण/अध्ययन गर्ने निम्न लिखित प्रस्पेक्टहरू लगानीका लागि उपलब्ध रहेका छन्:

**शारदा चुनडुंगा, दाङ र सल्यान :**

निजी क्षेत्रको प्रशासबाट पत्ता लगाई टोपोग्राफिक सर्भे, जियोसोनिकल म्यापिङ्ग, च्यानल म्यापिङ्ग, रसायनिक विश्लेषण आदि कार्यहरू सम्पन्न गरी प्रारम्भिक प्रतिवेदन तयार भएको यस डिपोजिटमा जम्मा ५२.५ करोड टन मिमेन्ट ग्रेड चुनडुंगा भण्डार भएको अनुमान गरिएको छ। यो डिपोजिट दाङ र सल्यान जिल्लाको सिमानामा पर्दछ। डिपोजिट बाट लगभग ८ कि.मि. टाढा पुरनधारासम्म दाङ मुक्तिपुरबाट आउने क्विच बाटो बनिमकेको छ। खानी तथा भूगर्भ विभागबाट खोज तलाम प्रमाण पत्र लिई निजी क्षेत्रबाट अन्वेषण भैरहेको भएता पनि संयुक्त लगानी गर्ने अवसर उपलब्ध रहेको छ। प्राप्त आँकडा अनुसार यो डिपोजिट अधिराज्यकै सबैभन्दा ठूलो मिमेन्टको थोत हुनसक्ने देखिएको छ तर विस्तृत अन्वेषण कार्य गरी डिपोजिट प्रमाणित गर्न बाँँक नै छ।

**लखरपाटा चुनडुंगा, सुर्खेत**

करिब ३ करोड टन मिमेन्ट बनाउन उपयुक्त चुनडुंगा भएको यो डिपोजिटको ड्रिलिङ्ग बाहेक अन्य विस्तृत अन्वेषण खानी तथा भूगर्भ विभागबाट भएको छ। कच्चा पदार्थहरू चुनडुंगा तथा रातो माटोको प्राविधिक परिक्षण भैसकेको यस खनिज भण्डारको भूमीगत अवस्था याँकित गर्ने आवश्यक ड्रिलिङ्ग र सम्भाव्यता अध्ययनको लागि प्रस्ताव गरिएको छ।

**दिशारीगाड चुनडुंगा, बैतडी :**

प्रारम्भिक सर्भेक्षणबाट करिब १७ करोड टन मिमेन्ट बनाउन उपयुक्त चुनडुंगा भएको सकेत पाइएको यस प्रस्पेक्टमा हाल खानी तथा भूगर्भ विभागबाट विस्तृत कार्यक्रम सञ्चालन गर्ने लडाँ राखिएको छ। उक्त खनिज भण्डार प्रमाणित भएको खण्डमा भविष्यमा लगानीका लागि उपलब्ध हुने छ। यो डिपोजिट बैतडी तथा गोकुले मोटर बाटोको छेउमै पर्दछ।

**मुमिश्वर/चौराहा चुनडुंगा, बैतडी :**

इडेल्धुरा-बैतडी मोटर बाटोको तजिक पर्ने यो चुनडुंगा खानी तथा भूगर्भ विभागबाट प्रारम्भिक अन्वेषण गरिएको हो। खनिजको परिमाण जम्मा ४ करोड टन जति हुन सक्ने सकेत पाइएको छ। विस्तृत अन्वेषण कार्य गर्ने तर्फ ईच्छुक लगानीकर्ताको लागि उपलब्ध हुन सक्छ।

**मुसा चुनडुंगा, अर्घाखाँची :**

अन्वेषणात्मक ड्रिलिङ्ग बाहेक अन्य विस्तृत अन्वेषण कार्य पुरा भएको यो डिपोजिट गोग्रसंगे/अर्घाखाँची मोटर बाटोले भेट्दछ। जम्मा ८२ लाख टन मिमेन्ट ग्रेड चुनडुंगा भएको यो डिपोजिट लगानीको लागि उपलब्ध छ।

**ध्याम्पाकुम्हा-चुलाडाडा, हरेदार, सिन्धुली चुनडुंगा, उदयपुर**

प्रारम्भिक अध्ययनबाट करिब ४ करोड टन हुन सक्ने अनुमान गरिएको यो प्रस्पेक्ट खानी तथा भूगर्भ विभागबाट अन्वेषण कार्य भइरहेको छ। निकट भविष्यमा निजी लगानीको लागि उपलब्ध हुन सक्छ।

**कम्पुघाट खानेसाईट, उदयपुर**

प्रारम्भिक सर्भेक्षणबाट करिब २ करोड टन न्यूनमाध्यम गुणस्तर भएको यो डिपोजिट विस्तृत अन्वेषणको लागि उपलब्ध छ।



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Over 2 decade's experience in waterwell drilling and pile foundation

**डोलोमाइट, उदयपुर :**

जम्मा ४८ लाख टन उच्च गुणस्तरको खनिज भएको यो डिपोजिट विस्तृत अन्वेषण तथा पूर्व सम्भाव्यता अध्ययनका लागि उपलब्ध छ ।

यस वर्गमा पर्ने अन्य मात्रा स्तरका खनिज भण्डारहरू निम्न छन् ।

चुनडुगा, हलेशी, खोटाङ (अनुमानित भण्डार ६०.० लाख टन)	
" " गन्दु पनौती, काभ्रे । " " ४६.० लाख टन)	
" " भट्टेडाँडा, ललितपुर । " " ४६.० लाख टन)	
" " माने, निगुरे, भादुमार, काभ्रे । " " २७.० लाख टन)	
" " बन्धली, काभ्रे । " " ४.५ लाख टन)	

**खोज तलासकालागि उपलब्ध अन्य सम्भावित क्षेत्रहरू**

सामान्यतया मिश्रित प्रकारको खनिज पदार्थहरू खास प्रकारको भौगोलिक वातावरण वा चट्टानसँग आबद्ध रहेका हुन्छन् । उदाहरणको लागि नेपालको पारिस्थितिमा धातु खनिज जस्तै तामा, फलाम, शिशा, जस्ता तत्त्वो हिमाली भेगका अर्ध-परिवर्तित चट्टानहरू (Meta-sediments) मा पाइन्छन् भने बहुमूल्य पत्थरहरू उच्च हिमाली भेगको उच्च स्तरीय परिवर्तित चट्टानहरू (Metamorphic rocks) मा रहेका हुन्छन् । टिन, टाइसटन धातु घेनाईट जस्ता आग्नेय चट्टानहरू (Igneous rocks) मा पाइन्छ भने कोइला, तेल, ग्याँस हुने सम्भावना चुरे र तराई क्षेत्रका पत्रे चट्टानहरू (Sedimentary rocks) मा देखिन्छ । नेपालमा सुन मुख्यतः यहाँका प्रमुख नदीहरूले बगाएर ल्याएको बालुवामा पाईएको छ भने यसको धोत मध्य तथा उच्च हिमाली भागका परिवर्तित चट्टानहरूमा भएको सकेत पाईएको छ । यसै गरी सिमेन्ट बनाउने उपयुक्त चुनडुगा कार्बोनेट चट्टानमा मात्र हुने र यसको चट्टान खास गरेर महाभारत पर्वत र यसको आसपासमा पाईन सके अनुमान गर्ने सकिन्छ । अतः अधिराज्यको भौगोलिक वातावरणको आधारमा खोज तलासकालागि निम्नानुसार खनिज र सम्भाव्य क्षेत्रको निर्धारण गर्न सकिन्छ । जुन निजी क्षेत्रबाट लगानी गरि अन्वेषण गर्न खुला रहेका छन् ।

**सिमेन्ट ग्रेड चुनडुगा र डोलोमाइट :**

महाभारत क्षेत्रमा पाईने कार्बोनेटहरू, विशेषतः चैतडी, सल्यान, अर्घाखाँची, गुल्मी, पाँचथर, स्याङ्जा, धादिङ, उदयपुर जिल्ला भित्र पर्ने कार्बोनेटहरू ।

**स्वाजाईट (मिल्का ग्लास) :**

स्याङ्जा, कास्की, तनहु, नवलपरासी, धनकुटा ।

**फोस्फोराईट :**

चैतडी, बभ्राङ, सुनसरी ।

**सुन :**

चैतडी, दाचुला (महाकाली, चमलिया नदीहरू), रोल्पा (जुङ्गी खोला, गाम खोला), काली गण्डकी र यसका शाखा नदीहरू (म्याग्दी र मोदी), पृथ्वी गण्डकी, त्रिशुली, सुनकोशी आदि ।

**क्रिप्टिन तथा अर्ध-क्रिप्टिन पत्थर (टुमोलिन, बेरील, अक्वामार्गिन, रुवी, गार्नेट, टोपाज, अन्य) :**

जाजरकोट, मनाङ (ताजे), धादिङ (गणेश हिमाल क्षेत्र), रसुवा, खजुवासभा, इलाम र ताप्लेजुङ्ग ।

**कोइला / मिट्टी कोइला :**

कोइला (दाङ, सल्यान, रोल्पा, प्युठान, अर्घाखाँची, पाँचथर)

मिट्टी कोइला (काठमाडौं उपत्यकाका विभिन्न स्थान) ।

**मावेल, घेनाईट र अन्य डायमोन्ड स्टाइन (पोलिस्ड स्टाइन) :**

ललितपुर, काभ्रे, मिर्चुली, उदयपुर, डोईलधुरा, मकवानपुर, गोरखा, धादिङ, इलाम, धनकुटा आदि ।

**खरी**

धादिङ, स्याङ्जा, तनहु, बभ्राङ, काभ्रेपलान्चोक, दोलखा, दाचुला आदि ।

**डुंगा, रोडा, बालुवा :**

अधिराज्य भरका नदी र खोलाहरू, मुख्यतया चुरे क्षेत्रमा बग्ने नदीहरू ।

**नेपालमा उपलब्ध खनिज पदार्थहरू**

(स्थलगत अध्ययनको आधारमा)

**क. प्रचुर मात्रामा रहेका चट्टान खनिज पदार्थ (भविष्यमा उद्योगमा परिणत हुन सक्ने)**

- १) सिमेन्ट ग्रेड साइमस्टोन तथा डोलोमाइट (प्रयोग: सिमेन्ट, साइमस्टोन, क्याल्सियम कार्बाइड, फिलर क्लस्स, अग्नेय, इन्वाइट तनुर, मिट्टी, निर्माणमुखी डुंगा आदि)
- २) मावेल (प्रयोग: पोलिस्ड स्लाब सजावट तथा अन्य निर्माणमुखी डुंगा)
- ३) स्लेट (प्रयोग: छड्कने डुंगा, सजावट गर्ने डुंगा)
- ४) क्वारजाईट (प्रयोग: स्लाम बनाउन, निर्माणमुखी)
- ५) म्याग्नेसाइट (प्रयोग: डेइबर्न्ट म्याग्नेसाइट, गिटल फ्ल्याश तथा फलाम पगाल्ने भट्टिमा)
- ६) घेनाईट (प्रयोग: पोलिस्ड स्लाब तथा अन्य निर्माणमुखी)
- ७) नदी वा खोलाको घाबेल, बोल्टर तथा बालुवा (प्रयोग: निर्माणमुखी) ।

**ख. कम मात्रामा उपलब्ध हुने खनिज पदार्थहरू (आर्थिक लाभप्रद हुन र नहुन सक्ने):**

- |                   |                       |
|-------------------|-----------------------|
| १) शिशा/जस्ता     | ९) अभ्रक              |
| २) तामा           | १०) युरेनियम          |
| ३) फलाम           | ११) नून               |
| ४) सुन            | १२) डायटोमाईट         |
| ५) बहुमूल्य पत्थर | १३) क्वाजोलिन         |
| ६) कोइला          | १४) बेफिलिन साइनाईट   |
| ७) खरी (टास्क)    | १५) क्वाट्स क्वाज     |
| ८) फोस्फोराईट     | १६) क्युरिन (गार्नेट) |

**ग. संकेत मात्र पाईएका:**

- |               |           |
|---------------|-----------|
| १) कोबाल्ट    | ५) बेराईट |
| २) टिन टाइसटन | ६) निकेल  |
| ३) ग्राफाईट   | ७) जिप्सम |
| ४) चाँदी      |           |

**घ. अन्य (राष्ट्र सम्भावना भएका):**

- १) खनिज तेल (पेट्रोलियम) तथा ग्याँस
- २) तातोपानी (धर्मल स्प्रिङ्स)

खानी ऐन, नियम तथा नीतिगत व्यवस्था

देशको दुनतर आर्थिक विकासका लागि देशमा रहेको खानी तथा खनिज श्रोतहरूको विकासमा निजी लगानी आकर्षित गर्ने उद्देश्यले २०४२ सालमा जारी भै २०५६ साल भाद्र ३१ गतेदेखि खानी तथा खनिज पदार्थ ऐन २०४२ लागू भएको छ । साथै श्री ५ को सरकारले उक्त ऐनको उद्देश्य कार्यान्वयन गर्ने सोही मितिदेखि खानी तथा खनिज नियमावली २०४६ लागू गरेको छ । खनिज पदार्थको स्वामित्व, खनिज वर्गीकरण, उत्पादनको आधारमा स्तर निर्धारण, खनिज पदार्थको गुण, प्रकार, स्तर र परिमाणको आधारमा रोयन्टी तथा अन्य शुल्क निर्धारण, अनुमति पत्र प्रमाणपत्रको प्रमाणपत्र, खोजतलास प्रमाणपत्र, उत्खनन प्रमाणपत्र तथा नवीकरण आदिको नीतिगत तथा प्रक्रियागत व्यवस्था उक्त ऐन तथा नियमावलीले गरेको छ ।

उपसंहार

जनसङ्की देशमा पनि खनिजजन्य उद्योगले राष्ट्रको विकासमा अहम भूमिका खेलेको हुन्छ । संभावनाका अवसरहरू विद्यमान हुँदाहुँदै

पनि सच्चा लगानिकर्ताको अवसरमा राष्ट्रले खनिज क्षेत्रबाट क्षारी फाइदा लिन नसकेको स्थिति रहेको छ । मुलुकमा हाल भैरहेको भौतिक संरचना तथा पूर्वाधार निर्माणको गति र हात ६०% भन्दा बढी सिमेन्ट विदेशबाट आयात भैरहेको अवस्था दृष्टिगत गर्दा देशमा पर्याप्त मात्रामा रहेको स्थानीय श्रोतमा आधारित सिमेन्ट उद्योगमा गरिने लगानी ज्यादै आकर्षक देखिन्छ । साथै नेपालमा सर्वभन्दा ठूलो खनिज भण्डारको रूपमा रहेका निर्माणमुखि पत्थर जस्तै लाईमस्टोन, डोलोमाइट, क्वार्ट्जाइट, ग्रेनाइट, स्लेट आदिमा उच्चतम लगानी गरी ढुंगा वा चट्टान श्रोत नभएको छिमेकी देश बंगलादेश र भारतको उत्तर प्रदेश, बिहार बंगाल जस्ता राज्यहरूमा समेत निर्यात गर्ने संकेताश पनि मुलुकको अर्थतन्त्रमा प्रभावकारी परिवर्तन आउन सक्छ । देशमा उपलब्ध सर्वभन्दा ठूलो र उत्प्रेरकको म्याग्नेसाइट खनिज भण्डार भएर पनि समग्रमै उत्खनन गरी डेढ बन्ट म्याग्नेसाइट उत्पादनमा ल्याउन नसक्दा हाल उक्त उद्योग धरासाई हुन पुगेको छ ।

## Mineral Industries and their contribution in National Economy

नेपालमा संचालित खानी तथा खनिज उद्योगहरू र राष्ट्रिय अर्थतन्त्रमा पुर्‍याएको योगदान

बाबुराजा जर्वाल, जगदिश्वर नाथ श्रेष्ठ

खानी तथा भूगर्भ विभाग, लैनचौर, काठमाडौं

सारांश

परापूर्व काल देखिनै नेपालको खनिजमा आधारित सामानहरू उत्पादन गरिन्थो । अपर्याप्त खनिज भण्डार तथा खनिज उत्खनन तथा प्रसोधनमा प्रयोग बढ्दै गएको परम्परागत प्रविधिको कारण खनिजमा आधारित उद्योगहरू हराएर गएका छन् । तत्पश्चात् मावामा केही धातु खनिजमा आधारित उद्योगहरू संचालनमा देखिएतापनि अधातु खनिजले नेपालको महत्वपूर्ण खनिज उत्पादन भएको छ । नेपालमा सिमेन्ट तथा अन्य बस्तुहरू उत्पादनको लागि चुनढुंगा, माधारण निर्माणमुखि खनिज पदार्थ (ढुंगा, बालुवा, स्लेट) तथा माटोटकोइला, पत्थरकोइला जस्ता इन्धन खनिजहरू उत्खननीय रूपमा उत्पादन हुने गरेका छन् । अक्सामेग्न, ग्रेनाइट, क्वार्ट्ज, क्वार्ट्जाइट तथा टुमोलाइट जस्ता अर्धकीर्मी तथा कीर्मी पत्थर तथा तुल जस्ता खनिजहरू पनि नेपालमा उत्पादन हुने गरेका छन् ।

नेपालमा चुनढुंगा, म्याग्नेसाइट, डोलोमाइट, प्राकृतिक ग्यास तथा माधारण निर्माणमुखि खनिजको विशाल भण्डार हुनुका साथै कच्चा तेल (पेट्रोलियम पदार्थ) को पनि ठूलो सम्भावना रहेको छ । नयाँ तथा पुराना गरि आर्थिक वर्ष २०५८/५९ मा ७० वटा खनिज खोजतलास तथा ५६ वटा माधारण निर्माणमुखि खनिज वारेका खनिज उत्खनन अनुमतिपत्र तहानि रहेको र सोही आर्थिक वर्षमा खानी तथा भूगर्भ विभागले रु ६० लाख भन्दा बढि राजस्व र रोयल्टि अर्जित गरेको छ भने आउँदो आ. व. मा रु १ करोड राजस्व संकलन गर्ने लक्ष्य राखेको छ ।

खानी तथा भूगर्भ विभागले हाल सम्म गरेको अन्वेषण कार्यको आधार मा आर्थिक दृष्टिकोणले आंशिक रूपमा मात्र लाभदायक हुने तामा, सिंसा, जस्ता तथा फलामको भण्डार भेटिएतापनि आर्थिक दृष्टिकोणले पूर्ण लाभदायक हुने खालका धातु खनिजको भण्डार भने फेला परेको छैन ।

आर्थिक दृष्टिले उपयोग हुने केहि मावामा सिंसा, जस्ता तथा फलामको भण्डार भेटिएतापनि आर्थिक तथा प्राविधिक समस्याले गर्दा तिनीको उत्पादन भने हुन सकेको छैनन् ।

नेपालमा क्रण्डै १ अरब १९८ करोड ५० लाख टन चुनढुंगा, १८ करोड टन म्याग्नेसाइट, तराइ क्षेत्रको २० जिल्लामा मात्र ५ करोड ५ लाख टन माधारण निर्माणमुखि खनिज, काठमाडौं उपत्यकामा मात्र ३० करोड घनमिटर प्राकृतिक ग्यास तथा ५० लाख टन कोइलाको भण्डार प्रमाणित भइसकेको छ । अन्य क्षेत्रको साना साना भण्डारको अलावा सिन्धुपाल्चोक जिल्लाको खिरढुंगा क्षेत्रमा मात्र १ करोड ६० लाख टन खिरढुंगाको भण्डार भेटिएको छ । ४८ लाख टन प्रमाणित डोलोमाइट भण्डारको अलावा मार्बल (सिंहमर्मर) पनि उत्पादन भइ रहेको छ ।

आर्थिक वर्ष २०५८/५९ मा Gross Domestic Product मा खनिज क्षेत्रको योगदान क्रण्डै रु २ अरब १९ करोड १० लाख रहेको छ । सम्बन्धित क्षेत्र (खानी तथा भूगर्भ विभाग) बाट मात्र नभई खनिज उद्योगहरूबाट श्री ५ को सरकारलाई प्राप्त हुने राजस्व कर कार्यालय तथा अन्य क्षेत्रबाट समेत अर्जित गरिने हुदा राष्ट्रिय अर्थतन्त्रमा खनिज क्षेत्रको योगदान बारे वास्तविक अंक अझ स्पष्ट हुन सकेको छैन जसले गर्दा बुद्धिजीविनले समेत खनिज क्षेत्रलाई अनुत्पादक क्षेत्रको रूपमा जनसमक्ष प्रस्तुत गर्ने गरेका छन् ।

खनिजमा आधारित उद्योगहरू देशको सर्व उद्योगहरू मध्येनै एउटा ठूलो ग्रंश ओगटेर बसेको छ । राष्ट्रिय अर्थतन्त्रमा खनिज क्षेत्रको योगदान ०.४ देखि ०.६ प्रतिशत मात्र देखिएता पनि यो क्षेत्रमा श्री ५ को सरकार ले लगानि गरेको तुलनामा कैयन गुणा प्रतिफल प्राप्त भएको छ । यस क्षेत्रले कैयन व्यक्तिलाई प्रत्यक्ष र अप्रत्यक्ष रोजगारी दिएको मात्र हैन कि



आयात प्रतिस्थापन गरि विदेशी मुद्राको समेत बचत गरेको छ र साथसाथै सम्बन्धित (ancillary) उद्योगहरूको पनि विकास भएको छ। यस क्षेत्रमा श्री ५ को सरकारले ३८ वर्षमा ऋति लगानि गरेको भियो त्यति रकम मात्र केहि उद्योगले दुई आर्थिक वर्षमै राजस्व तथा अन्य दस्तुरको रूपमा तिर्ने गरेको छ। प्रतिफलको तुलनामा यस क्षेत्रमा श्री ५ को सरकारले गरेको लगानि लगन्य रहेको छ।

खनिज क्षेत्रमा वैज्ञानिक ढंगले प्रशासनिक कार्य गर्नको लागि श्री ५ को सरकारले ऐन नियम तथा निर्देशिका जारी गरि लागु समेत गरि सकेको छ। यसरी जारी गरिएका ऐन नियमहरूले खनिज कार्य गर्ने अनुमति लिने, दिने प्रक्या तथा उत्पादन परिमाणको आधारमा लाग्ने रोयल्टी, राजस्व तथा अन्य दस्तुरहरू तोक्नुको साथै नियमित निरीक्षण तथा अनुमगनको व्यवस्था गरेको छ।

## Problems and issues in operation of mines and mineral based industries in Nepal

G. R. Manandhar and R. Mandal  
*Godawari Marble Industries Pvt. Ltd.*

### ABSTRACT

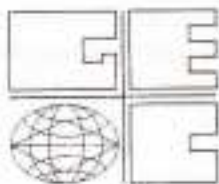
The minerals and minerals based industries are the backbone of the modern society and hold second position after agriculture. The history of mining in Nepal is quite old but still in infant stage and will remain so if substantial changes are not made in government policy. Some of the mineral based industries have become sick due to several reasons and need immediate rescue operation. The existing infrastructure should be improved and legal framework should be refined to attract national and international entrepreneurs. Eco-friendly/green mining will not have any adverse effect on the environment and will facilitate sustainable development. Forest authority should have positive attitude towards mining industries. Steep topography and fragile geology are the two main factors causing problem in the mining operation and slope stability all over the country, which can be overcome by proper planning. The scattered small-scale mining operations all over the country should also comply with good mining practices.

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## Present Status and Issues in Exploration and Exploitation/Mining of Mineral Resources in Nepal

(नेपालमा खनिज अन्वेषण, खानी उत्खनन, साना खनिज उद्योग संचालनमा हालको अवस्था र उद्योगहरूले भोग्नु परेका समस्याहरू)

मुचन ताल श्रेष्ठ

अध्यक्ष, नेपाल खानी उद्योग संघ

"रत्नगर्भो वसुधारा" पृथ्वीको गर्भ भित्र रत्नी रत्न छैन, भन्ने वैदिक भनाइ अनुसारको हाम्रो मागको पृथ्वी भित्र के कति रत्नहरू (खानी) छन्, आजसम्म एकिन गर्न सकिएको छैन। हालसम्म नेपाल अधिराज्यमा पत्ता लागिसकेका खानीहरूमध्ये केहीको साथै ईमानदारीताका साथ विकास गर्ने सकिएको भए अवश्य पनि देशको आर्थिक स्थिति राम्रो हुने थियो तर त्यसो हुन सकेको छैन। दोलखाको म्याग्नेसाइट उद्योग स्थापना भए पनि हाल बन्द भएको छ। लमजुङ खड्ग भई सकेका सिमेन्ट उद्योगहरूमध्ये पनि एउटा न बन्द भई सकेको छ र अन्य पनि बस्तुरै बन्द हुने स्थितिमा पुग्न केही बेर छैन।

हाम्रो देशमा स्थापित प्राचिन उद्योगहरूमध्ये खानी उद्योग पनि प्रमुख थियो। भनिन्छ उक्त समयमा देशका ठाउँ ठाउँमा साना साना तामा, फलाम खानी संचालन गरी तामा तथा फलामका घाउहरूबाट तामा र फलाम उत्पादन गर्ने गर्दथे र उत्पादित ती वस्तुहरू भोट तिर पनि निकाल्ने गरिन्थे। पूर्वको काप्पा, जल्लेखानी र पाँचचमको बागलुङ, रुकुम, कास्कीका तामाखानीबाट उत्पादित तामाबाट पैसा बनाउने र केही मात्रामा भाँडा बगन बनाई वा चक्कीको रुपमा विक्री गरिन्थ्यो। यसैगरी ठासेलेकवान र गेल्याका फलाम खानीबाट आवश्यक कृषि र घरजु सामग्रीको साथै ठोसेमा बन्दुक बनाउने कारखाना स्थापना गरी बन्दुकको गालहरू बनाउने गरिन्थ्यो तर अब यी सबै दुर्लभता बनि सकेका छन्।

नेपालमा खानीहरू अवस्थान स्पष्टा संचालन गर्ने र उद्योग स्थापना गर्ने २००७ साल अगोस्ट हिमाल माइनिङ सिन्डिकेट लि. को नामले कम्पनी खडा गरि त्यस मार्फत प्रधानमन्त्रीबाट पूर्व र त, पश्चिम र त, उत्तर हिमाल, दक्षिण महाभारत क्षेत्र भित्रमा खानी खोज्ने, खोज्ने अधिकार दिने मन्द भएको थियो। पूर्वको सैलुङ, सिस्नोचोका तामाखानी, पाती बज्याङको फाफाइट खानी र गणेश हिमालको जस्ता, शिमा खानी पत्तालग्नाई फाफाइट प्रशोधन गर्ने कारखाना स्थापना गरिएका थियो। यस भन्दा अघि गोदावरीको मार्बल भित्र गोदावरी मार्बल फेक्टरी लि. र दाहको कोइलाको लागि दाह कोल कम्पनी खडा भएपनि २०१३ साल सम्ममा मध्य कम्पनीहरू लिक्लिडेसलमा पुगेका थिए। त्यतिबेला खानी विभागको स्थापना भईसकेकोले त्यस पछि राज्यको तर्फबाट देशमा भएका खानीहरूको खोज तलास गर्ने काम विभागबाटै शुरू हुन थाल्यो। सन् १९६७ मा खानी विभागले प्रकाशन गरेको "गाइड टु मिनेरल रिजर्भ इन नेपाल" नामक पुस्तिका र यस भन्दा धेरै अघि "नेपालका खानीको परिचय" नामक पुस्तक हेर्दा नेपालमा विभिन्न प्रकारका खानीहरू रहेको स्पष्ट हुन्छ। प्रति वर्ष खानी खोज तलासका लागि श्री ५ को सरकारले केही न केही बजेट छुट्टाएकै छ र यसबाट कति खानीहरू पत्ता लागे खानी तथा मूल्य विभागको रेकर्ड तथा प्रतिवेदनबाट ज्ञान सकिन्छ।

२०३४/०३५ साल तिर वि.एल. श्रेष्ठको खानी सम्बन्धी एउटा लेख र यस अघि रामेश्वर मास्केले निजी क्षेत्रबाट संचालन भएका खनिज उद्योगको बारे गोरखापत्रमा प्रकाशन गरेको लेखमा मास्केले दिएको तथ्याङ्क अनुसार पाँचौ योजना समान हुनु भन्दा अघि निजी क्षेत्रले घामिण तथा घरजु उद्योग स्तरमा संचालित करिब ३५१ वटा खानी अन्य उद्योगमा एन.आई.डि.सी. ले लगानी गरेको पनि उल्लेख गरेको भएपनि उक्त समयमा खानी विभागबाट धेरै नै खानीहरूको ईजाजतपत्र दिइएको थियो भने हाल जाएर कोइला, मिट्टिकोइला, चूनडुङ, मुन, रातोमाटो, डोलासाइट, खरी, किमति, अर्थिकभूति पत्थरको समेत जम्मा २३ वटा खानीको ईजाजतमा सीमित हुनुपरेको छ। जुन बखत प्राविधिक ज्ञान र पूँजीको कमी थियो त्यस बखत खानी उद्योगको विकास हुने तर अब पूँजी र प्राविधिक ज्ञान प्रचुर मात्रामा रहेको भने दुवै उद्योग बाहेक अरुको विकास नहुनुमा सर्वसाधारणलाई आश्चर्य लाग्नु स्वभाविक हो। हुनत यसमा धेरै कारणहरू होलान् तर मुख्यतः श्री ५ को सरकारको यसतर्फ राम्रो ध्यान नजान्नु र १५-२० वटा पैच फुकाएर विदेशबाट सामान ल्याइ यहाँ जोडजाड गर्ने उद्योगहरूलाई प्रोत्साहन दिने नीतिनले गर्दा नै खनिज उद्योगको विकास हुन नसकेको हो भन्नुमा अत्युक्ति नहोला।

नेपाल खानी उद्योग संघले यसको स्थापना काल (२०२४ साल) देखि नै सम्बन्धित विभाग, मन्त्रालय, प्रधानमन्त्री र उद्योगमन्त्रीहरूसँग खनिज उद्योगको विकास गर्ने मुकामहरू र यसमा गरि आएका अयोग्यहरूको जानकारी गराउँदै आएको हो तर यसमा हालसम्म खानी केही हुन सकेको छैन। यस संघले २०३४मा एउटा कार्यक्रम गरी चेम्बर, उद्योग, बाणिज्य संघ का प्रतिनिधिहरू र अन्य उद्यमी व्यापारीहरूलाई एकैचलेमा राखि एक कार्यक्रम गरिएको थियो। त्यसबखत तत्कालिन विभागीय डाईरेक्टरज्यूले खानी उद्योग संचालन गर्ने चाहने निजी क्षेत्रलाई श्री ५ को सरकारले सफो सहयोग प्रदान गर्ने छ" भन्नु भएको थियो। नेपालमा खानीहरू नभएको होइन। तर ज्ञानुर्गका खानी जस्तै फलाम, तामा, शिमा, जस्ता, मुन, टीन, टइमण्टल आदिको भण्डारहरू माना भएका र तिनको छेउ पनि कम भएको र पूर्वाधारको विकास पनि नभइसकेकोले ज्ञानुर्गका खानीहरूको संचालन समानै भए पनि अझान् वर्षमा पनि खानीहरूको भने संचालन र विकास भई सकेका छन् र लासौ मजदुरहरूले काम पनि पाई सकेका छन्। दुवै उद्योग वा यहाँको खानीको विकासका लागि उद्योगीहरूलाई निकै सहूलियत र प्रोत्साहन दिने पुर्ब निर्देशक पुण्यभक्त मल्ल थिए। फलस्वरूप २०१७, २०१८ मा खानी विभागमा उद्योगीहरूको निकै चहल पहल रह्यो।

घाँटाघाँटा, पुन, घर निर्माण इत्यादिको विकासले २०३४, २०३५ सालतिर देशमा दुवै रोडाको माग निकै बढ्दै गएको थियो। यसरी निर्माणभूख खनिज वस्तुहरूको बढ्दो मागले गर्दा दुवै खानीहरू राम्ररी संचालन हुन थालेका थिए। जस्तै गर्दा त्यस्ता ठाउँका गरीब जनताले



काम पनि पाई राहत पाउन थालेका थिए । तर त्यसपछि दुहा खानीको अधिकार, सगौं प्राविधिकहरू र प्रशासनिक अधिकारीहरू राखि खनिज उद्योगको विकासका लागि खडा गरिएको खानी विभागबाट भिकि त्यस्ता कुनै पनि जनशक्ति नभएका तर राजनैतिक व्यक्तिहरूको जमघट रहने जिल्ला पंचायत तथा हालको जि.वि.स.मा दुहा, रोडा, बालुवा खानीको अनुमति दिने अधिकार दिइएकाले र वन विभागले वन ऐन, नियममा खनिज धनमा पर्ने, चहान, दुहा, बालुवा इत्यादिलाई वन पैदावार हुन भनि परिभाषित गरिदिनाले स्थिति अझ जटिल भएर गएको छ जुन खनिज उद्योगीको लागि ठूलो दुर्भाग्य भएको छ ।

वन विभागले खनिज उद्योगीहरूलाई पकड्ने, धुन छेक्ने गर्ने, बिभिन्न निठमा दुहाखानीहरू संशोधन गर्ने नाउँद्वारा २०५५ सालमा नेपाल खानी उद्योग संघले बाकिएका ऐन नियमहरू संशोधन गर्ने उच्चस्तरीय सम्बन्धित विभाग, मन्त्रालयका प्रतिनिधिहरू रहेको समिति बनाई आवश्यक संशोधन गर्ने राखिएका मागमा मन्त्री स्तरीय निर्णय भई, वन विभाग, खानी विभाग, स्थानीय विकास मन्त्रालय, वन तथा मू-संरक्षण मन्त्रालय, उद्योग मन्त्रालय, जनसंख्या तथा वातावरण मन्त्रालय, नेपाल खानी उद्योग संघ र जिल्ला विकास समितिका प्रतिनिधिहरू रहेको एउटा कमिटी गठन गरी, वन ऐन २०४९ र वन नियम, २०५१, नेपाल खानी ऐन २०२३, जिल्ला विकास समिति ऐन २०४८, औद्योगिक व्यवसाय ऐन २०४९, वातावरण संरक्षण नियमावली २०२४ र श्री ५ को सरकारको दुहा खानी सम्बन्धी २०५०/१०/१२ को निर्णयहरू पुनरावलोकन गरि निर्देशिका तयार गर्ने विषय राखि वनको संयोजकत्वमा एउटा बैठक बस्थो र निर्देशिका मस्यौदा तयार गरि छलफल गर्ने निर्णय भयो तर त्यसमा छलफलले नगरी नगराई पुग्ने आफ्ना निर्देशिकाहरू संशोधन गराउने काम वन विभागले गरेपछि विवाद यथावत् कायमै रहयो र उपत्यका बाहिरका दुहा खानीबाट र खोलाका दुहा उत्खनन् गरी तराई हाल सम्म पनि उसले रोयल्टी उठाउने गरेको छ ।

अर्कोतर्फ खानी विभागले २०१८ सालको नियमलाई २०५६ सालमा आएर खनिज नियम बनायो जुन अनुदार हुनु परेको छ र प्रतिपक्ष अव्यवहारिक र कानून संग बाझीपका छन् । नियमको दफा १३ को (१) मा अनुमती प्राप्त व्यक्तिले अविभागा, साता, मझौला र ठूला स्तरको खनिज पदार्थको क्रमश पाँच वर्ष, दशवर्ष, बीस वर्ष र तीस वर्षको अवधि भित्र नियममा उल्लेख भए अनुसार उत्खननकार्य सम्पन्न गरी सक्नु पर्ने । सो अवधि भित्र नसकेमा पुनः क्रमश एकवर्ष, दुई वर्ष, पाँच वर्ष र दश वर्ष सम्मको म्याद थप गरिदिने र सो पाँछ स्वतः दुजायज खारेज हुने उल्लेख भएको छ । जुन रफ्तानले उत्पादन गर्नु पर्ने भन्ने छ उत्पादित खनिज वस्तु विक्रीमा हुन्छ नै भन्ने कुनै ग्यारेन्टी नरहेको, तर म्याद भित्र वस्तु भिक्रीनसकेमा लगानी लगाई राखेको व्यक्तिको अनुमति खारेजहुने, सो पाँछ खानी अरु कसैलाई दिने व्यवस्था भएकाले वस्तो प्रदान, खानीलाई उद्योगको रूपमा नहेरि ठेकदारीको रूपमा विकास गर्न चाहेको जस्तो देखिन्छ ।

दफा ३८ मा निर्माण भूखी खनिज पदार्थको खानीकाय अनुगमन गर्दा आवश्यक निर्देशन दिन र रोक्का वा खारेज गर्न सक्ने जि.वि.स.लाई अधिकार दिइएको छ । यस्ता उद्योगीहरूलाई आफ्नो भनाई राख्नसम्म दिने व्यवस्था छैन । यसै कारण कोठमाडौं जिल्ला समिति र अरु केही समितिले प्रत्येक वर्ष जिल्ला भरका खानीहरू आफ्नोदेखि कार्तिक मसिरसम्म चलाउन रोक्का गर्ने र तबिकरण नगर्ने गरी आएका छन् ।

दफा ४६ को (२) मा अनुमति प्राप्त व्यक्तिले खनिज कार्यगर्न अनुमति पत्रमा उल्लेखित क्षेत्रको जग्गा निजीस्वामीत्वको भए भूचालमा निज दिनका लागि रकम उल्लेख गरी मन्जुरीनामा पेश गर्नु पर्ने भन्ने रहेको, तर खानी ऐन २०४२ को दफा २१ को (ख) मा त्यस्तो जग्गा निजी स्वामीत्वको भए श्री ५ को सरकारले अनुमति प्राप्त व्यक्तिलाई निजको खर्चमा प्रचलित कानून समोजिम प्राप्त गराई दिन वा भूचालमा दिनाई दिनसक्ने छ भन्नाले कानून संग नियम बाझिएको छ ।

कुनै पनि खनिज अनुमति प्राप्त व्यक्ति वा कम्पनीले प्राप्त खानीको मुकी विक्री गर्ने वा नामसारी गरी लिने, दिने, ऐन नियममा उल्लेख नहुँदा त्यस्तो कार्य गर्न नपाइने स्पष्ट छ । उद्योग व्यापारमा उद्योग कम्पनीको खरीद विक्री चलिरहने प्रक्रिया हो । तर यहाँ नामसारी रोक्काको अर्थ बृम्भ नसकिने कुरा भएको छ ।

**खनिज उद्योगले तिर्नु पर्ने करहरू**

(क) अनुमतिमा उल्लेखित खनिज क्षेत्रको जग्गा सरकारी भए भूचाल सरकारीलाई तिर्नुपर्ने भन्ने खानी नियमको ४६ मा उल्लेख भएपनि प्राप्त गर्ने क्षेत्र सबैको भूचाल खानी विभागले पाँच लिने गरेको छ ।

(ख) उत्पादन रोयल्टी ।

(ग) त्यस्ता रोयल्टीमा १० प्रतिशत स्थानीय विकास शुल्क ।

(घ) स्थानीय स्वायत्त शासन नियमावली २०५६ अनुसार प्रति टिप रु. ६०/- नियम प्रकाशित केही समय पछि तुरुन्त संशोधन गरी प्रति टिपको रु. ३००/- गरियो ।

(ङ) वन विभागको रोयल्टी यसमा सम्बन्धित गा.वि.स.हरू, स्थानीय स्तबहरू र जग्गाबालाहरूले प्रत्येक टिपमा रकम उठाइने अवगति छदैछन् ।

**जिल्ला विकास समितिबाट गरिएका अवैध कार्यहरू**

श्री ५ को सरकारको २०५० माघको निर्णयबाट जुन उद्देश्य राखी जि.वि.स.लाई अधिकार प्रदान गरेको वियो त्यस्तो ठीक विपरित कार्यहरू भएको छ र यसका उदाहरणहरू प्रष्ट छन् ।

**खनिज उद्योगहरू संशोधन र विकास गर्नका लागि केही सुझावहरू**

(क) विवादित कानून नियमको संशोधन, खानी उद्योग प्रति लगाएका अव्यवहारिक कर, रोयल्टीको खारेजी, खनिज नियमलाई व्यवहारिक र उदार बनाउन संशोधन गरिनु आवश्यक छ ।

(ख) खनिज उद्योग प्रति उद्योगीहरूलाई आकर्षण गर्ने सुविधा युक्त स्थलमा खानी उत्खनन् गरी उद्योग स्थापना गर्नेलाई १५ वर्षसम्म र विकट स्थलमा र घामीण क्षेत्रमा उत्खनन् गरी उद्योग खडा गर्नेलाई २५ वर्षसम्मको आकर्षक तथा म्याद छुट दिनुपर्ने ।

(ग) खानी जन्म उद्योग ठेकदारी नभई उद्योग हो आवश्यक कानून, नियमको व्यवस्था गर्न समय समयमा सरकारी निकाय, उद्योगी र उद्येमीहरू बीच छलफल हुनु पर्ने ।

- (घ) जि.वि.स. बाट निर्माण सामग्री ढुंगा, स्लेट इत्यादिको अनुमतिपत्र दिने अधिकार भित्रिक पुनः खानी तथा भूगर्भ विभागलाई नै दिनुपर्दछ। उद्योगीहरूबाट जे जति उठाउन पर्ने कर, रोचन्टी हो त्यो सबै खानी विभागबाटै उठाई जि.वि.स.लाई दिनु पर्ने प्रतिशत दिने व्यवस्था हुनु पर्ने।
- (ङ) खानी उद्योगहरूलाई जसले जुन पैसा पायो बन्द गर्ने, नबिकरण रोक्ने जस्ता कार्य रोखिनु पर्ने, र कुनै विवाद परे मध्यस्तकता खडागरी विवाद समाधान गर्नु पर्ने।
- (च) हाल फेही सिमेन्ट कारखाना र खेरी ढुंगा खानीहरू मात्र संचालनमा छन्। तर जि.वि.स. र खनिज नियम, बलको अवरोध आदिनेगर्दा ढुंगा कसिइ गर्नेले खानीबाट ढुंगा नलिई खोलाको ढुंगा कसिइ गर्न लागेको हुँदा ढुंगा खानीहरूको भविष्य पनि दिन प्रति दिन बिग्रदो छ।
- (ज) जि.वि.स.बाट यो अधिकार भित्रिक मजकुरा ढुंगा खानीहरू व्यवस्थित हुनेछन्। यसपछि साधारण ढुंगा, चुन ढुंगा, माचल, डोलोमाईट, प्येनाईट र यसै अरु खनिज पदार्थहरूको निकालि बंगलादेशमा गर्न सकिने र यसबाट देशमा अराबी विदेशी मुद्रा भित्राउन सकिने छ। तर हाल भारत भएर बंगलादेश जाने मोटर बाटोको ठाउँठाउँमा भारतीय अधिकारीहरूबाट कमेला लगाउने भएको हुँदा निकासीकर्ताहरूमा निरासा आएको छ। वास्तवमा श्री ५ को सरकारले भत्ताबाट बंगलादेश जाने बाटोलाई रेलमार्ग बनाइनु अटि गर्नु पर्छ। कोशी, गण्डकी, बौधहरूका लागि नेपालको हजारौं बिगाह जमिन दिन सक्छौं भने भारतीय खण्डको केही जमिनबाट रेल्वे लाईन लग्न भारत सरकार संग लिन किन सक्दैनौं? यस्तो हुन सकेमा नेपालका खनिज उद्योगहरूको विकास मात्र होइन कि त्यसो भुतुक संगको नेपालको व्यापारघाटामा पनि सुधार आउने छ।

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## **■ NATIONAL SEMINAR CUM WORKSHOP ON MAIN CENTRAL THRUST (MCT) IN NEPAL HIMALAYA- ISSUES AND PROBLEMS**

One day National Seminar Cum Workshop on "Main Central Thrust (MCT) in Nepal Himalaya – Issues and Problems" was organized by Nepal Geological Society in cooperation with Department of Mines and Geology, Department of Geology/ Tribhuvan University and other organizations on 7 March 2003 (23 Falgun 2059 B.S.). The seminar was inaugurated by the Chief Guest Hon. Dr. Yuba Raj Khatriwada, Member, National Planning Commission. The inaugural session was chaired by Mr. N.R. Sthapit, Director General, Department of Mines and Geology. In the beginning of the inaugural session of the seminar Mr. P. S. Tater, President of NGS delivered the welcome speech. Mr. R. K. Aryal Convener of the seminar highlighted on the objective of the Seminar cum Workshop. Mr. N.R. Sthapit, Chairman of the inaugural session highlighted on the importance of the Seminar on MCT. At the end Mr. Rajendra Prasad Khanal, General Secretary of NGS, extended the vote of thanks to the guests, all the participants and well wishers. Inaugural Session was followed by 2 Technical Sessions in which 6 papers were presented by the professional geologists from Nepal, India and Japan. After the presentation lively discussions were held in cordial atmosphere. At the end a colloquium was organized. At the same time it was decided to form a Working Committee on MCT.

### **Inaugural speech by the Chief Guest, Hon. Dr. Yuba Raj Khatriwada, Member National Planning Commission, Nepal.**

Mr. Chairman,  
Distinguished Scientists,  
Participants to the Seminar,  
Ladies and Gentlemen,

It is a great privilege for me to be invited to this important seminar of geo-scientists and engineers organized by the Nepal Geological Society. Indeed it is a great pleasure for me to inaugurate this National Seminar on "Main Central Thrust in Nepal Himalaya – Issues and Problems". I wish to thank the organizers of the seminar.

I am pleased to know that so many scientists of this country have been devoting their efforts in better understanding of Main Central Thrust in the Nepal Himalaya. As all of us know that Main Central Thrust (MCT) is a major tectonic break which separates the Lesser Himalayan Sediments with that of Higher Himalayan Crystalline and is also considered responsible for creating slope instabilities in and around the region. Slope instabilities, not only increases the cost of infrastructures developments but also cause damages despite due attention in the design and construction of dams, roads, bridges, irrigation canals, tunnels etc. So defining, characterizing, identifying and delineating the MCT on its tectonic and structural model has been very necessary.

It is my pleasure to know that the different researchers of Main Central Thrust are meeting here today to discuss various issues and problems relating the Main Central Thrust. The discussions, research results of different researchers, and interaction of so many scientists to be addressed here in the seminar will certainly come out with firm and decisive conclusions regarding Main Central Thrust in Nepal Himalaya. As a result it could provide better design parameters for infrastructure development in Nepal.

The Nepal Geological society deserves congratulation for organizing this meeting. I am glad to know that the society has been able to coordinate the efforts not only of Nepalese geo-scientists but also has a strong international membership. The network it has established makes it look like an international center giving opportunities to the Nepalese geo-scientists to effectively communicate with their counterparts from other countries.

I congratulate the Nepal Geological Society for organizing the seminar of this kind and thank to all the participating scientists.

Thank You.

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## ● ABSTRACTS OF THE PAPERS PRESENTED DURING THE WORKSHOP ON MAIN CENTRAL THRUST (MCT)

### **Some geological considerations for delineating the Main Central Thrust in Nepal Himalaya**

**Megh Raj Dhital**

*Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu, Nepal*

Though the Main Central Thrust (MCT) is considered to be one of the fundamental structural features of the Himalaya, its delineation is rather problematic. It is a challenging and time-consuming endeavour to locate the MCT in the field due partly to the high altitude, rugged and inaccessibility of the mountain range, and also due to the intense deformation and metamorphism. The MCT, like any other fault, is basically a structural entity. It has comparatively well-defined hanging wall and footwall separated by a shear zone. Generally, the shear zone is wider towards the hinterland and narrower towards the foreland. The MCT is also characterised by a large (about 100 km) amount of horizontal displacement of the hanging wall.

Inverted grade of metamorphism is another important aspect of the MCT. Commonly, the grade of metamorphism of the footwall increases from chlorite to garnet grade whereas the metamorphism in the hanging wall starts from garnet grade and continues to increase up to the sillimanite grade, after which it decreases quite rapidly.

Most of the problems related to the delineation of MCT in Nepal arise owing to the following weaknesses:

- \* Scanty data and poor-quality of field mapping,
- \* Reliance on indirect methods than on the direct field observations,
- \* Lack of stratigraphic or structural control,
- \* Violation of fundamental geological principles such as the crosscutting relationship of structures and the law of superposition of strata,
- \* Placing more importance to the "concepts" and "models" rather than to the geological facts, and
- \* Denial of the fundamental nature of the MCT as a thrust fault.

The paper highlights the main features of the MCT. It also discusses some erroneous positions of the MCT, and presents the facts and figures that help to delineate the fault more precisely in the field.

### **Higher Himalayan Shear Zone, Main Central Thrust and Zaskar Shear Zone: Their Deformation Patterns and Characteristics, NW Himalaya**

**A. K. Jain**

*Department of Earth Sciences, Indian Institute of Technology, Roorkee  
Roorkee 247 667, India*

The Main Central Thrust (MCT) has been considered in the Himalayan literature as one of the most significant intracrustal tectonic boundary of the collision tectonics and has played vital role in the Himalayan deformation, inverted metamorphism, leucogranite generation, exhumation, uplift and fast erosion of the Great Himalayan Range. On the contrary, the NW Himalaya between Kashmir and Garhwal is characterized by the presence of a 15-20 km thick intracontinental ductile shear zone, the Higher Himalayan Shear Zone (HHSZ), which is bounded by the discrete thrust zone – the Main Central Thrust (MCT) and its various splays at the base and the Zaskar Shear Zone at its top. The HHSZ is marked by ductile shearing with profuse and penetrative S-C shear fabric and other structures having top-to-SW overthrust sense of



movement, defined consistently by orthogonally-plunging mineral/stretching lineation. This belt is also characterized by synchronous amphibolite facies metamorphism, its inversion, migmatization, anatexis and leucogranite generation.

In the NW Himalaya, discrete narrow ductile to brittle thrust zones like the Main Central Thrust demarcate the basal boundary of the HHSZ and imbricate this belt. Many of these thrusts possibly juxtapose the distinct domains having Nd and Sr isotopic signatures. It is possible that the Nepalese sections across the MCT reveal these as zones of much higher shear strain so as to make distinction between two episodes really difficult.

Some of the unsolved problems of the Higher Himalayan Shear Zone, the Main Central Thrust (MCT) and the extensional Zaskar Shear Zone between Nepal and NW-Himalaya pertain to the differences in its characters e.g.,

- Does the MCT really play an important role in inverted metamorphism, leucogranite generation, penetrative deformation etc.,
- What are the geochronological constraints on shear-fabric, MCT-controlled fabric and extensional fabric and
- Is the metamorphic pile (HMB) coalesced terrain.

These questions can only be answered by joint scientific programme between India and Nepal with strong geological, geochemical and geochronological data inputs.

## **Main Central Thrust as Guide to Some Economic Minerals in the Nepal Himalayas**

**P. R. Joshi**

*Department of Mines and Geology, Lainchaur, Kathmandu, Nepal*

The Main Central Thrust following almost east – west direction is a well known structural feature in Nepal as it is prevalent on other parts of the Himalayan regions. Its existence in Nepal Himalayas is recognized by the association appearance of the Pre-cambrian rocks such as schist, gneiss and migmatites containing mineral assemblage like biotite, staurolite, kyanite and sillimanite over the younger rocks. The Main Central Zone in Nepal pass mainly through the lower parts of the Higher Himalaya which is one of the rugged, forbidden and poorly accessible terrain condition in the country rendering its study and precious demarcation a difficult task. Though presence of known economic minerals do not exhibit direct relationship to the Main Central Thrust, they show some affinity to a specific rock type inherent in the Main Central Thrust Zone. Association of monazite in the amphibolite are the commonly observed characteristics in this region. Occurrences of gem minerals like sphalerite and galena in the sugary dolomite, uraninite, tantalite, wadsworthite, pyrochlore, cassiterite and beryl in the pegmatite, and scheelite in the amphibolite are the commonly observed characteristics in this dolomite. Aquamarine, black and colored tourmaline, spessartite, grossularite, moonstone and quartz are also significant features in high grade metamorphic rocks of the MCT Zone. Other economic minerals like almandine garnet, sillimanite are also equally important mineral commodities in this region. Of the identified zinc and lead resource i.e. Ganesh Himal zinc-lead deposit, of commercial value is in the mine development process. Gem minerals like ruby, sapphire, aquamarine, beryl, tourmaline, kyanite, garnet and quartz are mined in small scale as some economic sources in the remote areas of the Higher Himalaya.

## **Main Central Thrust in Kathmandu Region, Central Nepal**

**Santa Man Rai**

*Department of Geology, Tri-Chandra Campus, Tribhuvan University, Kathmandu, Nepal*

Three tectonic units in Kathmandu region are distinguished on the basis of structure and lithology: the Gosainkund Crystalline Nappe (GCN), Kathmandu Crystalline Nappe (KCN) and Lesser Himalaya (LH) from north to south. The GCN corresponds to the southward continuation of the Higher Himalayan Crystallines (HHC) of Langtang area. The KCN is out-of-sequence thrust sheet in the LH. The amphibolite-granulite facies rocks of the GCN include varieties of

paragneiss and orthogneiss (augen gneiss, granitic gneiss), micaschist, calc-silicate gneiss, migmatite, marble and quartzite. The lower unit (Bhimphedi Group) of the KCN is composed of amphibolite-facies rocks (phyllite, schist, metasandstone, quartzite, and marble of Precambrian age). The upper unit (Phulchauki Group) of the KCN consists of greenschist-facies rocks and sedimentary rocks of Lower Paleozoic age (limestone, slate, metasandstone, phyllite, calc-phyllite and marble). The KCN is intruded by Cambrian-Ordovician peraluminous granitic plutons. The LH is composed of late Precambrian to Paleozoic? sedimentary and metasedimentary rocks such as limestone, schist, phyllite, gritstone, conglomerate, quartzite, augen gneiss (Ulleri augen gneiss) and amphibolite.

P-T conditions recorded in KCN ranges from 900 MPa to 720 MPa and 700 °C to 485 °C while, GCN records the P-T conditions ranging from 890 MPa to 580 MPa and 750 °C to 590 °C. The temperatures recorded in KCN are about 100 °C lower than those recorded in GCN. It is consistent with lower average temperature records in the KCN, suggesting that this unit rested at the same depth for a shorter duration than the GCN. The difference in temperature clearly shows that these two nappes are different from each other as also supported by evidence from the lithology, stratigraphy and metamorphism.

The southward extension of the GCN reaches the northern edge of the Kathmandu valley. Along the southern slope of the Sheopuri Range north of Kathmandu valley, the Tistung and Sopyang formations of the Phulchawki Group of the KCN are profusely intruded by a network of pegmatite vein or Nardanda Pegmatite (25 Ma) and have a tectonic contact with the sillimanite-grade gneiss and schist of the GCN over the biotite-grade metasandstone and phyllite of the KCN. This sharp tectonic break of metamorphic grade and lithology between the two nappes can be considered as the southward continuation of the late movement of MCT from north. The southern limb of the Likhu Khola anticlinorium represents the MCT-drag fold showing antisymmetric pattern developed at the frontal part of the GCN. The dips to the south are steeper than the dips to the north. Along the Tadi Khola and Likhu Khola sections north of Sheopuri Range, the paragneiss at the base of the GCN is highly sheared, with the presence of quartz boudins and highly stretched garnets along the foliation plane.

The Phulchawki Group of the KCN unconformably (?) overlies amphibolite-facies rocks of the Bhimphedi Group while the rocks of the Tibetan Sedimentary Series to the north of Gosainkund region overlie the amphibolite-granulite facies rocks of the Higher Himalayan Crystalline rocks along the north dipping normal fault known as South Tibetan Detachment System (STDS). No such distinct normal fault is well observed between the Phulchawki and Bhimphedi groups of the KCN.

The GCN belongs, without doubt, to the Higher Himalayan Crystallines, while the KCN was probably deposited on the northern edge of the continental marginal sea, at an intermediate position between the present LH and the HHC or GCN. During the Himalayan orogeny, the MCT carried out the HHC rocks over the KCN along the MCT and KCN was thrust over the LH along the Mahabharat Thrust (MT).

## **Nature and Position of the Main Central Thrust in the Pokhara area, Central Nepal**

**Lalu Prasad Paudel<sup>1</sup> and Kazunori Arita<sup>2</sup>**

<sup>1</sup>*Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu, Nepal*

<sup>2</sup>*Department of Earth and Planetary Sciences, Hokkaido University, Sapporo, Japan*

Although the Main Central Thrust (MCT) is believed to be a intracrustal thrust extending throughout the length of the Himalaya, its nature and position is very much obscured and has been debated for many years. In the present work, field observations, microstructural analysis and metamorphic data were combined in a study along the Seti River and Modi Khola valleys in the Pokhara area of central Nepal to understand the nature of the MCT. Several evidences demonstrate that the MCT is a sharp and discordant tectono-metamorphic boundary separating the Higher Himalaya from the Lesser Himalaya. In the Pokhara area, the MCT lies where

- 1) the lithology changes from interlayered psammitic, calcareous and carbonaceous phyllites and schists, metacarbonates and quartzites of the Lesser Himalaya to coarse-grained banded gneisses and schists of the Higher Himalaya,
- 2) detrital minerals like feldspar and tourmaline completely disappear in the metasediments,
- 3) the deformation style in feldspar changes from dominantly brittle fracturing to plastic flow,



- 4) the highly differentiated crenulation cleavage show their maximum development,
- 5) the plastic flow textures with rootless and pygmatic folds appear for the first time,
- 6) quartz microstructures change from ribbon structure to exaggerate grain growth microstructures,
- 7) pre-tectonic garnets accompanied by asymmetric pressure shadows appear for the first time,
- 8) garnet composition changes from dominantly spessartine-rich varieties to pyrope-rich varieties,
- 9) garnet zoning pattern changes from dominantly growth-type to retrograde-type,
- 10) white-mica composition changes from muscovite to phengite, and where
- 11) the plagioclase composition changes from albite to oligoclase.

Garnets were also analysed from the Arun Valley in east Nepal and the Jaljala area in west Nepal. The results were in accord with the results from the Pokhara area.

I believe that some or all of the above features should be recognized across the MCT in other sections of the Himalaya and provide important criteria to locate this important Himalayan thrust.

## MCT and Related Structures in the Region, North of Kathmandu

Megh Raj Dhital

*Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu, Nepal*

For the purpose of locating the Main Central Thrust (MCT) in the region north of Kathmandu, detailed field mapping was carried out on a scale of 1:25,000. The fieldwork was supplemented by the study of thin sections. The MCT was delineated on basis of the following main criteria:

- Lithostratigraphy of footwall and hanging wall,
- Inverted grade of metamorphism,
- Continuity of beds and bands, and
- Continuity of folds and faults.

### Lithostratigraphy of footwall and hanging wall

In the region east and northeast of Kathmandu, the rocks constituting the footwall of the MCT are represented by the Nawakot Complex. They belong to the Kuncha Formation, Benighat Slates, and Robang Formation, successively from bottom to top in the Chu Khola – Indrawati River – Melamchi Khola area. The other formations of the Nawakot Complex are missing due to faulting and facies changes.

In the eastern and northeastern areas, the hanging wall is made up of kyanite schist, sillimanite gneiss, quartzite, and augen gneisses belonging to the Kathmandu Complex. They are represented by the Raduwa Formation, Bhainsedobhan Marble, Kalitar Formation, Chisapani Quartzite, Kulikhani Formation, and the Tistung Formation.

In the Trishuli Ganga – Chiraundi Khola – Galchhi – Mahesh Khola – Kalphu Khola area lying west and northwest of Kathmandu, the upper part of the footwall of the MCT is made up of the Benighat Slates, Malekhu Limestone, and Robang Formation, respectively from bottom to top whereas the hanging wall contains the rocks belonging to the Raduwa Formation, Bhainsedobhan Marble, Kalitar Formation with the Pandrang Quartzite Member, Chisapani Quartzite, and the Kulikhani Formation, respectively from bottom to top.

### Inverted grade of metamorphism

In the eastern and northeastern sectors, the grade of metamorphism increases from the lower part of the footwall towards the hanging wall from slates to chlorite-biotite schist to garnetiferous schist, whereas the hanging wall is made up of kyanite schist followed by the sillimanite schist in the Talamarang area and around Sankhu. In the western and northwestern sectors, the chlorite-biotite schist of the footwall rapidly passes into the garnetiferous schist of the Raduwa Formation and the kyanite and sillimanite schist and gneiss of the Kalitar Formation. There is a wide zone of inverted metamorphism (more than 8 km thick) in the eastern sector whereas it is relatively narrow (about 3 km) in the western sector. After the



sillimanite zone, the grade of metamorphism rapidly decreases in both the areas and the rocks pass into the barely metamorphosed limestones and slates of the Phulchauki Group. In the Mahesh Khola-Kalpu Khola area, a progressive decrease in the grade of metamorphism above the MCT is evident by the successive occurrence of sillimanite, kyanite, staurolite, garnet, and biotite from bottom to top, respectively.

#### **Continuity of beds and bands**

The eastern and western flanks of the MCT sheet contain beds and bands that are essentially parallel to the thrust. The foliation in the hanging wall as well as the footwall is essentially parallel to the MCT. The area lying immediately north of the Kathmandu Valley contains rocks dipping moderately to gently due south, whereas the rocks in the Cha Khola and Melamchi area dip due southwest up to the Sindhu Khola and onwards they dip due northwest constituting a westerly-plunging anticline. In the Mahesh Khola-Kalpu Khola area, the Raduwa Formation, Kalitar Formation with the Pandrung Quartzite band together with the augen and banded gneiss continue towards the north for more than 20 km just parallel to the MCT.

#### **Continuity of folds and faults**

The mesoscopic and small-scale folds observed mainly in the Benighat Slates and the Jhiku Carbonates forming the footwall of the eastern flank do not continue towards the hanging wall. A major anticlinal axial trace passes through the Cha Khola. On the other hand, an anticline and a syncline are observed in the Kathmandu Complex, south and southeast of Sankhu. In the Mahesh Khola-Kalpu Khola area, there are many steeply plunging folds in the hanging wall that continue in the north almost parallel to the MCT. The mesoscopic and small-scale faults observed in the footwall do not continue in the hanging wall. Similarly, the structures seen in the hanging wall are also confined within the MCT sheet.

Based on the above criteria, it was concluded that the Mahabhart Thrust and the MCT are the same fault and there is no thrust fault running along the northern end of the Kathmandu Valley.

## **Terrane-Delimiting Main Central Thrust in the Central Sector of Himalaya**

**K. S. Valdiya**

*Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore 560 064, India*

The Main Central Thrust, depicted as Vaikrita Thrust, is recognized as a plane marking pronounced metamorphic break and abrupt change in style and orientation of structure, within the succession of crystalline rocks building the bulk of the snowy ranges in Kumaun Himalaya. Not only is there a jump of pressure of the order of 4 kb and temperature rise of  $> 200^{\circ}\text{C}$ , but also is there a conspicuous change of neodymium isotope value across the tectonic plane that separates the lower-grade metamorphics at the base from the high-grade metamorphic rocks above. While the basal low-grade metamorphic assemblage comprises  $1900 \pm 100$  Ma old highly tectonized porphyritic granite characterized by low initial strontium isotope ratio, the upper high-grade metamorphic group is intruded by  $20 \pm 1$  Ma old anatectic granite characterized by garnet, kyanite sillimanite and cordierite and a high but variable value of strontium isotope ratio. Significantly, the neodymium data demonstrates the similarity of the basal low-grade metamorphic rocks at the foot of the Great Himalaya with the crystalline rocks of the nappes and their klippen in the Lesser Himalaya terrane. Moreover, the anatectic Lower Miocene granite are singularly absent in the succession of these Lesser Himalayan nappes.

Although there is no geomorphic expression of the Vaikrita Thrust in the topography, a series of hot springs and the  $40^{\circ}$  NE-dipping seismic plane delineate the terrane boundary, the Main Central Thrust. It is this thrust that has flexed downwards the plane of decoupling and displacement between the underthrusting Indian plate and the overlying Himalayan mass.

## **☉ NATIONAL MEETING CUM SEMINAR ON THE OCCASION OF INTERNATIONAL STRATEGY FOR DISASTER REDUCTION (ISDR)-DAY**

On the occasion of International Strategy for Disaster Reduction Day (ISDR)-2002 Nepal Geological Society in collaboration with Ministry of Home Affairs/HMG, Disaster Mitigation Support Program, Department of Water Induced Disaster Prevention/HMG, Department of Mines and Geology/HMG, UNDP/ Nepal and NSET-Nepal had organized one day National Meeting cum Seminar on "Disaster Reduction for Sustainable Mountain Development" on 9th October 2002 in the meeting hall of Tourism Board, Bhrikutimandap, Kathmandu.

The Seminar was inaugurated by the Chief Guest, Hon. Dr. Jagdish Chandra Pokharel, Member, National Planning Commission and it was chaired by Mr. Tika Dutta Niraula, Secretary, Ministry of Home Affairs. At the outset of the Inaugural Session Mr. P. S. Tater, President of NGS, delivered a welcome speech. Mr. R. K. Aryal, the Convener of the Workshop highlighted on the aim of the workshop. In this session Mr. N. R. Sthapit, Director General, Department of Mines and Geology and Mr. A. N. Mishra, Director General, Dept. of Water Induced Disaster Prevention also delivered their speech about their departments contribution in disaster management. At the end of the Inaugural Session Mr. Rajendra P. Khanal, General Secretary of NGS offered the Vote of Thanks to the Guests, Participants and all other helping organizations. The Inaugural program was followed by two Technical Sessions in which 10 working papers were presented under the Chairmanship of Mr. P. R. Joshi and Prof. M. P. Sharma. Abstracts of the papers are presented below.



Inaugural Ceremony of the "International Strategy for Disaster Reduction Day (ISDR)-2002".



Honorable Dr. Jagadish Chandra Pokharel inaugurating the "International Strategy for Disaster Reduction Day (ISDR)-2002" in Kathmandu.



## **INTERNATIONAL STRATEGY FOR DISASTER REDUCTION DAY IN NEPAL**

The United Nations General Assembly defined a decade from 1990 to 1999 as the International Decade for Natural Disaster Reduction (IDNDR) in 1987 and adopted a resolution to drastically reduce damage from Natural Disasters. IDNDR started in 1990 as one of the activities of the United Nations. The second Wednesday of the October was declared the IDNDR -Day.

The IDNDR-Day was observed since 1991 in Nepal by organizing meetings, seminars and trainings. This program had received a national focus and many governmental and non-governmental organizations had been involved. The Nepal Geological Society (NGS) had, over the years been working in close cooperation with the IDNDR National Committee, Ministry of Home Affairs, UNDP/Nepal and Lutheran World Service Nepal in fulfilling the goals of IDNDR.

Nepal is a disaster prone country in the world. Because of her location, characterized by rugged topography, very steep slope, variable climatic conditions, complex geological structures with active tectonic process and continued seismic activities, the country is prone various types of natural hazards. These vary from snow avalanches and glacier lake outburst flood (GLOF) in the Higher Himalayas to fire and flood in the rest of the country. Landslides and earthquakes are frequent. They are causing extensive damage to the national economy and incurring heavy loss of life and property every year. Some government and non-government organizations are involved in the disaster reduction and mitigation works in Nepal.

The concept of IDNDR has been instrumental in transferring the emphasis from relief and rescue to preparedness. Various agencies of His Majesty's Government of Nepal like Ministry of Home Affairs, Department of Narcotics Control and Disaster management, Department of Water Induced Disaster Prevention, Department of Soil Conservation etc. are involved in disaster prevention, mitigation and management works in close cooperation with various international agencies such as United Nations Development Programme (UNDP), Japan International Cooperation Agency (JICA), Asian Disaster Reduction Centre (ADRC), Asian Disaster Preparedness Centre (ADPC), International Centre for Integrated Mountain development (ICIMOD), International Red Cross Society (IRCS), United Mission to Nepal (UMN), Cooperation for American for American Relief Everywhere (CARE), World Food Programme (WFP), Save the Children Fund (SCF),

Technical Cooperation of the Federal Republic of Germany (GTZ), Lutheran World Service (LWS), OXFAM etc. Besides these, various other professional and non-governmental organizations like Nepal Geological Society, Nepal Red Cross Society, Nepal Engineers' Association and NSET- Nepal are also providing highly valuable support for the natural disaster mitigation and management works in Nepal.

Based on the lessons learned from the International Decade for Natural Disaster Reduction (IDNDR), the UN has established the International Strategy for Disaster Reduction (ISDR) as a global framework for action with a view to enabling all societies to become resilient to the effects of natural hazards and related technological and environmental disasters in order to reduce human, economic and social losses. It involves a conceptual shift from an emphasis on disaster response to the management of risk through the integration of disaster reduction into sustainable development. The implementation of the strategy is premised to the establishment of partnerships between governments, non-government organizations, UN agencies, the scientific community, the media as well as other relevant stakeholders in the disaster reduction community. The four goals of the strategy are to increase public awareness about disaster reduction to obtain commitment from public authorities to stimulate inter-disciplinary and inter-sectoral partnerships, and the improve the scientific knowledge of the causes of natural disasters and the consequences of the impact of natural hazards.

National participation, as the primary ingredient for sub-regional, regional and international cooperation with regard to natural disaster reduction is a critical factor of the success of the ISDR. 'ISDR National Committee' or 'ISDR Focal Point' is designated by the government of each country and serve as an interface between national and international levels within ISDR. In any event the national platform should be kept informed and copied on all relevant correspondence between the Secretariat and contacts at national level. ISDR- Day has been proposed by the UN for second Wednesday of October of every year from 2001 onward. The Nepal Geological Society had observed ISDR-Day by conducting seminar on natural disaster reduction in close cooperation with Ministry of Home Affairs and UNDP/ Nepal. All concerned authorities of HMG of Nepal, all relevant Consulting Firms, NGOS and INGOs and Professional organizations as well as ward members of all municipalities of Kathmandu Valley are actively involved in the Seminar.





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## ■ ABSTRACTS OF THE PAPERS PRESENTED IN THE SEMINAR

### **Landslide investigation, assessment, and mitigation in Nepal**

**Megh Raj Dhital**

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During every monsoon, Nepal suffers from a heavy loss of lives and property due to landslides, debris flows, and related disasters. Most of the mass movements are geologically controlled and occur along major faults and fold axial traces as well as on dip slopes. Soil type, rock structure, precipitation, earthquake, and anthropogenic factors play a vital role in triggering the mass movements.

Landslide hazard assessment in Nepal is carried out by preparing various types of maps. These maps can be grouped into the following three categories: (1) the regional landslide hazard map, (2) the landslide hazard map of a corridor, and (3) the landslide hazard map of a site. The regional landslide hazard maps include watersheds, sub-watersheds, or part of them. These maps are used mainly for watershed management, infrastructure planning, and estimating erosion and sedimentation. The landslide hazard maps of a corridor are prepared for the purpose of comparing them with other alternatives, delineating hazardous areas for further studies, and estimating risks in the construction or maintenance of the linear infrastructure. On the other hand, the landslide hazard maps of a specific site are prepared for landslide monitoring as well as for delineating areas requiring mitigation measures.

Landslide control works in Nepal include retaining walls, check dams, surface and subsurface drains, rock and soil anchors, rock bolts, and bio-engineering systems.

A few examples of the above three types of landslide hazard map as well as the experience in landslide study, monitoring, and control are given from various parts of Nepal.

### **Promoting Safer Building Construction: Experiences of NSET-Nepal**

**Shiva Bahadur Pradhanang, Amod Mani Dixit, Varun Prasad Shrestha,  
Mahesh Nakarmi, Ramesh Guragain, Surya Narayan Shrestha,  
Ram Chandra Kandel, Surya Prasad Acharya**

To date, most residential buildings (even in urban areas of Nepal) do not receive any rational design for strength. Even though most municipalities (58 altogether) do have a system of building permits, there is no provision in the process to check strength criteria. The building permit process takes into account only the compliance related to planning (ground coverage, FAR) and building by-laws (height, provision of toilet, sewer and solid waste disposal). Kathmandu and Lalitpur municipalities now require some structural drawings (not design) for buildings with more than three storeys or a 1000 sq. ft. plinth area. Thus, there is poor institutional and technical capacity within the local authorities for implementing strength-related provisions if they were to be introduced in to the building permit process.

On the professional front, too, there is no system of controlling the professional standards of engineers/designers through reference to professional qualifications/ membership, peer review process or by legal means. Owner-builders who follow the advice of local craftsmen build more than 98 % of the buildings in Nepal. Neither the owner builder nor the crafts persons are aware of the possible disastrous consequences from an imminent earthquake. Neither do they have adequate access to information related to safer building practices and incorporation of simple earthquake-resisting features at nominal extra cost. Even the building construction projects funded by national and multilateral agencies do not spell out any requirements related to seismic safety when they hand over the terms of reference to their consultants.

*"As many as 60 percentages of all buildings in Kathmandu Valley are likely to be damaged heavily; many beyond repair"* is the result of loss estimation during earthquake scenario preparation under Kathmandu Valley Earthquake Risk Management Project, which was implemented by the National Society for Earthquake



Technology – Nepal and GeoHazards International, as a part of Asian Urban Disaster Mitigation Program of the Asian Disaster Preparedness Center with core funding from the Office of Foreign Disaster Assistance of USAID.

This paper is focused on analysis of existing construction mechanism and trends, implementation strategies, difficulties and lesson learned from the initiatives that have been taken by NSET-Nepal towards safer building construction in Nepal.

## **Flood Simulation for Developing Appropriate Mitigation Measures: A case study of Bagmati River, Nepal**

**Ambikesh Jha**

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Heavy rainfall followed by devastating floods and landslides has threatened civilizations and have caused many sufferings. Nepal has been no exception. Lack of advancements made towards rain and flood studies within Nepal has compelled to bear heavy grunts of flood devastation every year. Recent floods in July 2002 are an ideal example. It is therefore evident that there is an urgent need to study and develop advanced tools and techniques capable of predicting rainfall and runoff events correctly and efficiently. Lots of research work have been done in this regard elsewhere and is still continuing. However the applicability and purposefulness of each of the developments made so far has certain constraints. Models and tools developed for one place cannot be used straightaway into another one without making adjustments. An attempt has been made in this paper to use Soil and Water Assessment Tool (SWAT) with its GIS Interface for stream discharge simulation in Nepalese context. The SWAT Model is used to simulate the floods in Bagmati River at Karmahiya from 1991 through 2000, at the Siwalik foothill near the East West Highway for its validation and then to predict the future stream flow events. The model has shown good agreement with the simulated discharge matching the observed one by 97%. Hence it could be effectively used for the simulation purposes and future predictions under different scenarios. The results could then be utilized for development of appropriate flood mitigation measures.

## **Kinematics Analysis of Rock Slopes: A Case Study along the Naubishe Mugling Section of the Prithvi Highway**

**Indra Raj Humagain**

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Prithvi Highway has been interrupted for few days to some weeks during almost every monsoon. Most of the slope instabilities along the Highway are complex due to the combination of the circular, plain as well as wedge failures in soils, weathered rock as well as in the jointed rock mass. Falls, topples, buckles, and spreads are also common. Most of the failures along the road cut slopes are rooted to the rock slope instability. So the Kinematics Analysis of such rock facing slopes along the road is prerequisite for any sort of the slope stability analysis, slope protection as well as stabilization measures. Repeated failure events had occurred and huge investments have been demanded for the protection and controlled measures of the slopes due to lack of proper analysis of the rock slope in the very beginning of the instability problems. Slope Instability problems at Nugh Dhunga section, Jhaple Khola section, rock fall and slide near to Malekhu Khola section, Krishnabhir section, Jogimara section and Dahaki Bhir Section are the most serious problems related to the instability of the rock slope along the Prithvi Highway.

Slope instability problem at the Nugh Dhunga area of the Thankot Naubishe section of the Road during Monsoon of 1993 is very familiar. The area consisted of weathered rock cliff of phyllite. The problem could disturb the transportation time to time although the stability as well as controlled measures have already been applied. In spite of the stabilization as well as controlled measures the instability problem had been spread further. A very small wedge failure during the monsoon 2000 resulted the huge slide during Monsoon 2001 and similarly in Monsoon 2002. Result of the Kinematics Analysis of the discontinuity data of the rock mass in this section shows the potentiality of the wedge and plain failure along the discontinuity plains. Without knowing the fact, a huge massive Gabion Wall of about 8m high have been constructed at the end of monsoon 2002.



Such a massive wall in a already destabilized slope is ready to collapse during the coming monsoon.

About 50m high rock cliff near to Malekhu along the Prithvi Highway blocked the road traffic frequently since the construction of the road. Thickly foliated quartzite is exposed along the road cut slope in the section. Kinematic analysis shows the unstable wedges, block toppling and plain slides along the discontinuities. Just a protection wall had been constructed to protect the rolling of the blocks to the road and not a single stabilization and protection measures have been implements in the section.

A prominent slope instability problem called Krishnabhir Landslide had occurred at the chainage of km 57 + 500 along the Prithvi Highway during the Monsoon of 2000. The area consisted of deeply weathered rock cliff of Phyllite belonging to the Benighat Slate (Stocklin 1980) geological unit. The landslide began on 22<sup>nd</sup> June 2000 as small gully erosion as a result of the monsoon rain. As the colluvial cover fallen down and block the traffic, the debris had been removed from the road to continue the traffic without any measures in the crown part of the active slide. The material continued falling as the pore water pressure further weakened the resistance force and the landslide became the catastrophic landslide on 8<sup>th</sup> August 2000. This event blocked the traffic on the Highway for about two weeks. The condition of the landslide on 22<sup>nd</sup> August 2002 is as shown in picture (Fig. 1). This landslide disturbed about 300 m road length and the crown of the slide is located at about 400 m above the road section. The tension cracks are observed further 100 m upwards from the crown. This landslide became one of the biggest landslide in the Prithvi Highway. This landslide is still active and the debris are still falling down slope even during dry season. The road is opened temporarily by removing debris from the road and the stabilization and protection measures are still not applied in this landslide.



**Fig. 1: Krishnabhir Landslide at km 57+500 chainage**

A major landslide recognized as the Jogimara landslide had occurred at about 90 km west of Kathmandu along the Prithvi Highway. It was one of the most hazardous landslide on the Prithvi Highway from 1990 to 1995. The slide was about 150 m long along the road at the toe and 190 m high. The landslide occurred on the counter dip slope of the interbedded slate and limestone. The failed slope was steeper than 45° and sometime up to 60. This was a typical rockslide controlled by the discontinuity set 034/50. A central wedge had been formed by the Joint set 262/80 with the foliation of the rock 196/70. The overburden

and the debris of the whole landslide had been removed and the fresh rock with more shearing strength is exposed to stabilize the landslide. A gabion wall had been constructed to protect the road section from the possible block falls activity. The instability problems spread on both sides of the previous section. Results of the Kinematics analysis shows the wedge and plain failure condition in the newly spread section adjacent to the controlled one.

Another prominent slope instability problem is located at chainage of 72.7 km along the Prithvi Highway and recognized as the Dahakibhir. The recent event at this section has occurred on 1<sup>st</sup> September 2001. The road section from chainage 72.5 to 73.0 km passes through colluvail debris of an old landslide. Heavily weathered to completely weathered bed rock of gritty phyllite with quartzite intercalation is exposed adjacent to the landslide. The highly fractured and sheared rock mass along the steeper slope along with the thin old landslide colluvium is the major problem at this section. As the immediate measure to maintain the passage of the vehicle the responsible authorities of the Department of Road decided to the make a diversion of the road by further cutting the mountain slope consequently the cut slope cut the first slip surface of the old landslide. The old landslide has been reactivated and hence the simple problem has changed into a disaster. The disaster interrupted the traffic for about four days. Kinematic Analysis shows the plain and wedge failure condition of the rock slope in the section. Further instability in this road section will be more risky not only for the road but also for the Dahaki village situated just above the reactivated landslide.

## Articles



## Ground radiometric survey, prospection of radioactive minerals and its findings in Nepal

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### INTRODUCTION

A number of radioactive minerals occur in the earth. Among them Uranium is the most important one. It is the main source of nuclear energy (fuel in atomic reactor). It is also used in nuclear medicine, atomic weapons, technical and industrial appliances, age dating of rocks etc. Nepal does not have any atomic reactor or industry where we can utilize Uranium. At present, it is also not a priority mineral for the country although it is taken as strategic mineral. However, we must evaluate our natural resources so that we can utilize them whenever we really need it for domestic use as well as for export. Pegmatites, Granites and Syenites are the favorable host rocks for primary uranium mineralization. Secondary sandstone type uranium deposits are also reported from Pakistan, India and many other countries. From the published literatures it is known that more than 50% of the worlds known uranium deposits are of sedimentary origin.

### \* GROUND RADIOMETRIC SURVEY

In Nepal, preliminary ground radiometric survey covering nearly 8,000 sq. km area in the Siwalik region (Sub Himalaya) was carried out during 1981 to 1985 (Yadav et al.). It was able to trace quite a few but small and irregular radioactive bodies and define the target area for the follow up investigation. Most of the anomalous bodies are found associated with coaly materials and other organic remains with or without pyrite or marcacite in pebbly arkosic sandstone and in carbonaceous to lignitic silty shale beds.

Systematic follow-up ground radiometric survey in the Siwalik area lying between Kamala River in the east to Narayani River in the west (Kaphle and Pant 1988, Kaphle and Khan 1989) covering nearly 1,200 sq. km area was able to trace visible uranium mineral showing in the radioactive bodies in Buka Khola, Chiruwa Khola, Chandi Khola, Tinbhangale Khola, Mardar Khola and Panpa Khola section in the central Siwalik area. However, significant mineralization was recorded only in Tinbhangale area. In this area the mineralized body is 1-5 m thick and extend above 512 m in its strike length. Ground radiometric survey by 4 channel Gamma Ray Spectrometer revealed Total Counts up to 27,405 cps and U counts up to 437 cps which is more than 100 times of normal background value. Chemical analysis of stream water, stream sediments, residual soil and rock samples (ore) from Tinbhangale prospect revealed up to <1, 4, 12 and 1308 ppm uranium respectively.

Semi-detail radioactive mineral prospection in Tinbhangale - Chandi Khola area in Makwanpur district by Kaphle and Khan (1990) was able to trace out few mineralized bodies within coarse grained pebbly arkosic sandstone bed of upper part of Upper Middle Siwalik Formation (MS2) and basal part of Upper Siwalik Formation in Tinbhangale and Chandi Khola area. This mineralization is a sandstone type uranium mineralization, as it is known from the Suleiman Range in Pakistan and in Himanchal Pradesh in some parts of India. Physical properties like high radioactive intensity values, uraniferous bright sulphur to lemon yellow surface colouration of minerals associated with limonitic layers and fine coal fragments or organic remains and fairly high specific gravity etc. are the diagnostic characteristics of the ore.

Similarly preliminary and follow up ground radiometric survey/exploration in Baitadi and Darchula area (Kaphle and Khan 1992, 1993 and 1994) was able to detect a 3-8 m thick poorly sulphide ore bearing (with or without gold flakes/colours) radioactive quartzite beds and few lenses in Boregad, Bangabagar, Baghgoth, Jamari Gad section and in Gorang (Khan 1999 and 2001) in Baitadi district. Quite a few ore floats of high radioactive iron-copper sulphide  $\pm$  gold bearing quartzite in Jamari Gad and Chamliya River are also detected.

### RADIOACTIVE MINERAL PROSPECTS AND OCCURRENCES

#### Prospects

##### *Tinbhangale Prospect (Makwanpur)*

It lies within longitude  $85^{\circ} 16' 40'' - 85^{\circ} 18' 30''$  East and latitude  $27^{\circ} 15' 40'' - 27^{\circ} 16' 30''$  North. It is situated about 45 km east of Hetaunda in Makwanpur district, central Nepal. The prospect is easily approachable from Nijgad in east west highway. In Tinbhangale an east west elongated uranium mineralization band of 1 to 5 m thick and 512 m strike length (Table 1) was traced by 4 channel Gamma Ray Spectrometer and Scintillation Counter and the mineralized body was exposed by shallow trenching. The channel samples from the mineralized band showed <10 to 1308 ppm uranium in them (Radioactive Intensity Value measured by 4 channel Gamma Ray Spectrometer: Total counts (TC) up to 27405 cps and Uranium (U) counts up to 437cps. Thorium (Th) counts up to 30 cps and Potassium (K) counts up to 460 cps). The ore minerals recognized are *Uraniuminite*, *Carnotite* and *Coffinite*. In addition to these minerals other heavy minerals



like monazite, ilmenite, zircon, rutile and magnetite may also contain very little amounts of U and Th in their crystal lattice. On the basis of measured thickness, strike length, assumed depth and uranium content in the ore, the grade and tonnage is very roughly calculated as follows (Table 2).

The reserve calculation is based on surface trenching data. Therefore, the grade and tonnage have yet to be confirmed by drilling and core sample analysis.

#### Chandi Khola Prospect (Makwanpur)

It lies in between longitude 85° 19' 00" – 85° 21' 30" East latitude 27° 15' 00" – 27° 16' 30" North. It is situated 7 to 10 km east of Tinbhangle. There are 5 isolated, small mineralized bodies of various shape, size and grade as shown in the Table 3.

Almost all these mineralized bodies are small in size and scattered around Chandi Khola.

#### Gorang Prospect (Baitadi)

A 3-8 m thick and about 160 m long sulphide bearing poorly auriferous high radioactive quartzite band is detected near Gorang village in Baitadi (Khan 2001). The Radioactive Intensity value recorded by Scintillation Counter in this band is 1000 cps to 10,000 cps (Total counts). This mineralization band also contains primary gold. Therefore it appears to be prospective for further detail investigation.

#### Occurrence

Beside the sandstone type mineralization in Siwalik area, primary 'U' mineralization is also recorded in some pegmatites, granites, gneiss etc. in different parts of the country. Some of the known occurrences areas follow.

#### Thunki - Jagat area:

It lies at about 10 to 12 km north of Kathmandu. Shrestha (1964), Chaurasia (1976) had recorded few Autonite floats from the pegmatites in leucogranites. Follow up radiometric survey by DMG (1997) and MEDB (Mitchel and Summi 1980) could not trace any interesting mineralized body.

#### Kakani - Panchmane area:

The area lies at about 18 km north west of Kathmandu in Shivapuri lekh. Amatya (1980) has reported few high radioactive intensity value (readings) in soil above gneiss and leucogranite near Kakani Hill about 5km north east of Thunki. Heavy mineral study of that area has confirmed that **Xenotime** is the possible radioactive minerals present in the soil.

#### Mailung Khola area:

It lies about 75 km north west of Kathmandu. Amatya (1980) has recorded few high radioactive intensity values up to 8000 cps (Total counts) against 150 cps background reading in phyllite (Kuncha Formation) in Mailung Khola. The high radiometric source rock is believed to be the underlying granite and gneiss.

#### Higher Himalayan Granitic Area:

Radiometric survey of Higher Himalayan granites/gneiss has not yet been carried out by DMG. Only French Geological Expedition (research) group did some research works on Manaslu granite and near by areas. They have reported some occurrences of **uranium** along with zinc and silver on the glacier of the Annapurna-I south face at an approximate height of 13,800 ft.

#### Primary and Alluvial uranium occurrences in Baitadi/ Darchula Region

Kaphle and Khan (1992, 1993 and 1994) during heavy mineral panning detected alluvial 'U' minerals (uraninite, coffinite, monazite, rutile and zircon) along with fine gold colours (grains) in the heavy concentrate samples collected from the high as well as low flood plain of Janarigad, Chamliya River and Mahakali River. The 'U' content in the sediments varies from <1 to 12 ppm (in concentrate it is up to 2223 ppm). Similarly up to 672 ppm uranium was also detected in the ore floats and up to 16 ppm uranium in a 3-10 m thick quartzite band in Bangabagar and Baghgoth area in Baitadi.

From the preliminary and follow up Ground Radiometric Survey/ prospection in the above areas it became clear that

Table 1: Detail of the ore body

Mineralized body	Size Length x Width	U content (ppm)	Lithology	R.I. Value Measured in the outcrop in cps			
				TC	U	Th	K
1	512m x 1-5m	437	Coarse arkosic sandstone with fine coal fragments and organic remains	27405	437	30	460

Table 2: Geological reserve estimate of the deposit (by rough calculation)

Ore Body	Strike length (m)	Avg. thickness (m)	Est. depth (m)	Volume (m)	Avg. sp. gr	Estimated tonnage (mt)	Avg. Wt. grade %	U metal (mt)
1	512	2.2	50	56320	2.8	157,696	0.0225	3548.2

Table 3: Detail of the ore bodies

Mineralized body	Size Length x Width	U content (ppm)	Lithology	R.I. Value Measured in the outcrop in cps			
				TC	U	Th	K
I	1m x 15cm	227	Pb. cong. with fine coal lenses and sst. lenses at the base	2009	27	3	28
II	3m x 60cm	48	Conglomeratic Sst. with coal Lenses and Mst. Pockets	3242	42	3	43
III	3m x 50cm	218	Arkasic Sst. with coal lenses and Mst. Pockets.	1230	19	3	23
IV	5m x 1cm	21	Laminated carbonaceous shale with fine coaly materials.	1415	15	2	34
V	12m x 50cm to 1.5m	308	Pb. Sst. with cong. and Mst. Lenses with some coal fragments	1799	18	2	25

except Tinbhangale (Makwanpur) and Gorang (Baitadi) mineralization no other known occurrences appear to be of interesting for further follow up and detail investigation in future. However, neither of them is exploited so far. Besides uranium minerals few fine alluvial gold are also detected in Jamarigad, Chamliya River and Mahakali River sediments. Therefore, priority must be given to evaluate the alluvial gold and uranium in terraces and also look for primary uranium and gold mineralization (source rock) in the catchment areas of Jamari Gad and Chamliya River.

### RECOMMENDATION FOR FURTHER EXPLORATION

On the basis of known geological setting and lithofacies follow up and preliminary (reconnaissance) ground radiometric survey and follow up investigation in the following four regions and detail investigation in Gorang (Baitadi) and Tinbhangale (Makwanpur) areas are highly recommended.

#### Chamliya - Mahakali River area, Baitadi / Darchula District, Far-western Nepal

Follow up radiometric survey is proposed mainly in selected areas which are already covered by preliminary ground radiometric survey (in 1992, 1993) and reconnaissance ground radiometric survey in the virgin area in some parts of Jamari Gad, Chamliya and Mahakali River catchments areas. These areas lie on the toposheets 62 B/ 15, 62 C/7, 8, 9, 10, 13 and 14 (in parts) covering over 1,200 km<sup>2</sup>.

#### Gneissic rocks in Mailung Khola area, Rasuwa District

Preliminary ground radiometric survey is also proposed in this area on the basis of granite and gneissic lithofacies

and high R.I. values recorded by Amatya (1980). The proposed area lies in between longitude 85° 00' 00" - 85° 20' 30" East and latitude 27° 55' 00" - 87° 7' 00" North in toposheets 71 H/4, 8 and 71 E/15 covering about 500km<sup>2</sup> area.

#### Gneissic rocks in Charikot, Dolakha District

Similar gneisses as in Mailung also occur in Charikot area. The proposed area lies in between longitude 85° 00' 00" - 85° 30' 00" East and latitude 27° 40' 00" - 27° 50' 00" North on toposheets 72I/1, 5 and 6 covering about 560km<sup>2</sup>.

#### Manaslu Granite in Higher Himalaya

Occurrence of uranium along with zinc and silver on the glacier of the Annapurna-1 south face indicate possibility of uranium mineralization in this area. Therefore, preliminary radiometric survey around the Manaslu granite area lying between longitude 84° 15' 00" - 84° 55' 00" East and latitude 28° 22' 30" - 28° 40' 00" North in toposheet 71 D/6, 7, 10, 11, 14 and 15 covering about 750km<sup>2</sup>. is recommended.

### CONCLUSION

Radiometric survey in different parts of Nepal was able to trace some of the radioactive bodies in quite a few places in the Sub Himalaya (Siwalik Foot hills) and in Lesser Himalaya. Since most of them are small in size and low in grade only two prospects one at Tin Bhangale (Makwanpur) and other at Gorang (Baitadi) appears to be prospective. Follow up and detail investigation is recommended only in these two areas. However, preliminary and follow up investigations in the above 4 new areas may lead to find radioactive bodies, which may appear prospective for radioactive minerals in Nepal.



## **Erosion and deforestation in Nepal and the degrading Himalayan environment**

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### **INTRODUCTION**

The Himalayan mountain range forms the border zone between the Indian subcontinent in the south and the mainland Asia in the north. The birth and rise of the Himalaya and Tibet profoundly changed the global climate of the world and also exerts a strong influence on today's climate. It forms the most important climatic barriers of Asia. The development of the Indo-Gangetic plain and its vast array of rivers which formed the cradle of the great civilization of the Indian subcontinent also owe their origin to the Himalayan uplift.

### **THE RISE OF THE HIMALAYA**

The Himalaya is the youngest and the tallest mountain on the earth. This stalwart is the southernmost important mountain range of Asia. The Himalaya owes its birth and rise to the long march of the Indian plate towards north closing the Tethys Sea and the ultimate collision with Tibet around 50 million years ago; the process, which still continues today. Presently India is moving towards north at the rate of about 50 mm per year. This insistent push of India is the ultimate cause to make the Himalaya vibrant and dynamic, and maintain its majestic height. Tibet, the tableland of Asia, too is indebted to this Indian creep for its rise of over 4 km from sea level and maintaining its dominant posture. Recent Global Positioning System (GPS) measurement using satellites orbiting the earth shows that some part of the Nepal Himalaya is rising as fast as 7±2 mm per year (e.g. in central Nepal, NE of Kathmandu) in the forefront of the Higher Himalaya (Bilham et al. 1997). Similarly the Indus River incises through the bedrock at extremely high rates (2-12 mm per year), indicating a high uplift rate (Burbank et al. 1996).

The main part of the Himalaya attained high elevation at least 20-22 million years ago (France-Lanord et al. 1993, Galy et al. 1996). The onset of monsoon must have also coincided with this rise. The rising young mountain and the strong monsoon rain was the perfect combination for the high rate of erosion of the Himalaya and the production of great amount of sediment which was ultimately carried to the Bay of Bengal and Arabian Sea by the mighty Himalayan rivers like the Ganges, Brahmaputra and Indus. The Bengal and Indus Fans came into existence due to the accumulation of sediments from the rising Himalaya. A part of the sediment derived from the Himalaya has also been trapped in the Indo-Gangetic foreland basin (a subsiding basin developed at the front of a rising mountain) south of the mountain front.

Before we discuss the present-day erosion in the Himalaya, it will be quite interesting to know the erosional history of this mountain since its birth. There are various scientific methods to know the rate of uplift of the Himalaya, its sediment production and transportation, changes of rate of erosion and changes of vegetation types etc. More recent works on these lines have progressed to the extent that a better understanding of the erosional history of the Himalaya has started emerging.

### **BENGAL FAN: THE ARCHIVE OF EROSIONAL HISTORY OF THE HIMALAYA**

The sediments in the Bengal and Indus fans which owe their origin to the rising Himalaya have preserved the best record of the history of the Himalayan uplift, erosion and climatic changes. The study of these submarine fans as well as the sediments in the Indo-Gangetic foreland basin can tell us the Himalayan story in a most fascinating way. The Bengal Fan (Fig. 1) is the world's largest submarine fan, extending to about 3,000 km south from Bangladesh into the Indian Ocean (Curry, 1994). The sediments constituting the fan have a maximum thickness of approximately 22 km, and mass of the sediments derived from the mountain since its birth is about  $22.9 \times 10^{16}$  tons (Curry, 1991). The Ganges-Brahmaputra river system produces 5-12% of the river particulate flux (sediments) in the world's oceans, while providing 2.5% of the water flux (Milliman and Syvitski, 1992). Today, the Ganges and Brahmaputra rivers are the second and third largest sediment carriers in the world and the average annual suspended load carried by them to the Bay of Bengal is more than  $1.6 \times 10^9$  tons and  $0.8 \times 10^9$  tons respectively ( $2.4 \times 10^9$  tons combined) (Holeman, 1968). Some authors estimate the total sediment discharge to be about  $1 \times 10^9$  (C. France-Lanord pers. Comm.) to  $1.9 \times 10^9$  (Summerfield and Hulton, 1994) tons per year. However, these values do not include the sediments carried as the bed load (sediments carried along the bottom of the river), which may constitute a considerable proportion of the total sediment flux to the Bengal Fan.

If we divide the weight of the total accumulated sediment in the Bengal Fan by 22 million years, we get an average value of approximately  $1 \times 10^{11}$  tons/year, which represents the average annual rate of sediment flux into the Bengal Fan. Here, the sediment deposits trapped in the Ganges-Brahmaputra basin is not included. The accuracy of the estimate of sediment in the fan and the timing of the onset of monsoon need to be more refined for the sufficiently reliable



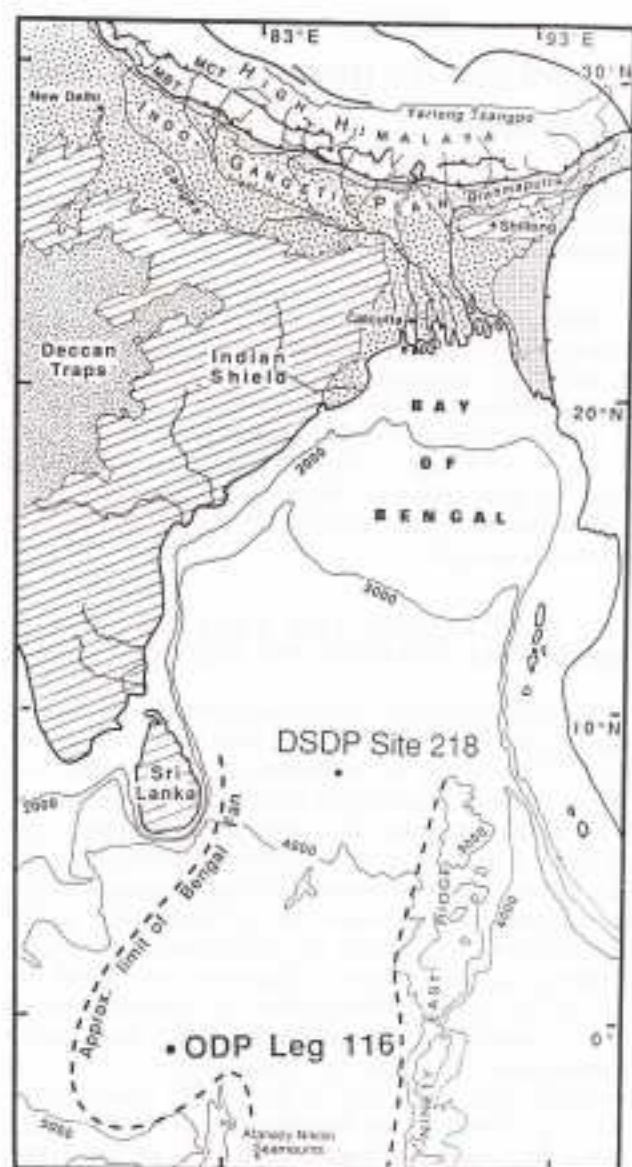


Fig. 1: The Bengal Fan and the Gangetic Plain (France-Lanord et al. 1993)

estimation of the above average sediment flux in the Bengal Fan in the past. Nonetheless, the estimated figure amply indicates that throughout its monsoonal history, Himalaya has remained an area characterized by high rate of erosion and the biggest supplier of sediment to the ocean and its foreland basin. The studies have also shown that the High Himalayan Range (Higher Himalayan crystalline rocks) was the main contributor to the sediments in the Bengal Fan during the past 20-22 million years (France Lanord et al., 1993).

Several lines of studies also show that the rate of erosion in the Himalaya may not have been the same throughout its Cenozoic (from 55 million years before to the present day) uplift (Derry and France-Lanord 1996; Burbank et al. 1993;

Burbank 1992). From approximately 17 to 7.4 million years, the depositional record in the Bengal Fan is marked by rapid sedimentation rates and a coarse-grained assemblages. An interval of accelerated deposition is also recorded from around 11 million years ago. Most of the post 7.4 million years interval is dominated by finer-grained clay rich strata (France-Lanord et al. 1993). Isotopic changes recorded by paleosol carbonates (ancient soil layers) of the Himalayan foreland basin and sedimentary and faunal changes in the Arabian Sea have been interpreted to represent an intensification of the Asian Monsoon during the late Miocene time (7-8 Ma ago) (Quade et al. 1989). Late Miocene uplift of the Tibetan Plateau and the Himalaya has been invoked as a key control on both regional and global climatic conditions and as a specific cause of monsoonal intensification (Raymo and Ruddiman 1992).

It has also been found that between 7.4 and 1 million years, the rate of delivery of detrital sediments derived from the Himalaya and Tibetan plateau decreased, rather than increased after this intensification (Burbank et al., 1993, 1996). The cause of the reduced sediment flux to the late Miocene basins is not known. This contradiction could be the result of declined rate of tectonically induced bedrock uplift, contributing to overall lower relief and detrital sediment delivery. The development of the monsoon climate may have been associated with decreased glaciation in the Himalaya, leading to decreased mechanical erosion, but increased chemical weathering rates. It may also be due to increased vegetation cover driven by the enhanced monsoon which may have stabilized slopes and decreased the detrital sediment flux (Burbank 1992; Burbank et al. 1993).

It has also been argued that the late Cenozoic uplift of many of the world's mountain ranges was a response to climate change rather than to tectonic (mountain building) processes. Burbank (1992) argues that the importance of erosional unloading has increased in the Himalaya during the past 4 million years. The record of considerable climate change leading to widespread glaciation during the late Cenozoic times is unambiguous in many mountain ranges. It is likely that repeated alpine glaciation led to enhanced rates of erosion in the Himalaya too. Therefore, it shows that tectonics as well as major climatic changes both can greatly influence the rate of erosion in the mountains.

## HIMALAYAN RIVERS: GREAT SEDIMENT CARRIERS OF THE WORLD

If we estimate the continent-wide soil erosion rate, it is striking to note that Asia comes at the very top. Out of about 20 billion tons ( $20 \times 10^9$  tons) of sediments annually carried to the sea by all the major rivers of the world, Asia alone constitutes 80 per cent of that load (Holeman, 1968). The Himalayan rivers viz., the Ganges, Brahmaputra and Indus rank second, third and fifth largest sediment carriers of the world respectively while their water discharge is relatively minor. They alone carry nearly one sixth of the world's total sediment to the ocean (Holeman 1968).



### Sediment Discharge Measurement

Recently, Sinha and Friend (1994) did a comprehensive study of the sediment and water flux of the major tributaries of the Ganges. They found that the mountain fed rivers are characterized by a very high discharge and a low suspended sediment concentration and the plains-fed rivers have relatively low discharge and high-suspended sediment concentration. The foothill-fed rivers have moderate values of discharge and suspended sediment concentration. It indicates that a large amount of sediment of the foreland basin is also being reworked by the rivers and transported to the ocean. Semi-quantitative estimates of water and sediment flux suggest that about 99.9% of the mass transfer into the plains is water, with the remaining 0.1% being sediment, and that 10% of the latter (0.01% of the total) is retained in the basin, the remainder being transferred to the Bengal Fan (Sinha and Friend 1994).

The present-day Indo-Gangetic plain is not only one of the world's largest areas of Quaternary alluvial sedimentation, it also forms the upper surface of one of the largest (approximately 3000 km x 200 km), still actively subsiding, foreland basins. Water and sediment flux of Gandak, Kosi, Bagmati, Burhi Gandaki (a river originating in the plains of Bihar in India) and Kamla-Balan rivers are shown in Table 1 (Sinha and Friend 1994).

Sinha and Friend (1994) also estimated the total sediment accommodated by subsidence in an eastern part of the foreland basin (in Bihar, India) and found to be 16.5 million tons/year (assuming the area of north Bihar plains to be 38,000 km<sup>2</sup>, basin depth of 4 km and subsiding over 20 million years giving rise to a subsidence rate of 0.2 mm/year, and assumed sediment density of 2.2 gm/cm<sup>3</sup>).

A long term measurement on the annual sediment load of the Kosi River from 1948 to 1981, however, shows that the total average annual suspended sediment loads at Barahakshetra and Baltara are 94.95 (about 142.42 million tons/year; assuming the sediment density to be 1.5 gm/cm<sup>3</sup>) and 57.35 million cubic meters/year (about 86.02 million tons/year) (RONAST/CWRC 1994). The average annual bed load is considered at 15% of the suspended load. The measurement of annual sediment loads at Barahakshetra and Baltara is shown in Table 2.

It is interesting to note that the sediment discharge at Baltara, India calculated by Sinha and Friend (1994) is only about half of the value obtained from a long-term measurement at the same place. Even if we compare only the fine sediment flux (suspended load), their value is much less than the value obtained from the long-term measurement. This shows that the data presented by different authors/agencies are not consistent and comparable in many cases. A more reliable database on sediment load of these Himalayan rivers based on long-term studies as well as using appropriate methodology is required for a more realistic interpretation on the present day rate of soil erosion in the Himalaya. The annual sediment load and sediment yield per km<sup>2</sup> of the tributaries to the Kosi River are presented in Table 3 (RONAST/CWRC 1994).

Very few works on sediment discharge are available for other major rivers of Nepal. In western Nepal, the sediment load of the Karnali River, another major river of Nepal, has been estimated at between 93.5 and 170 million tonnes/year. Similarly, the sediment load of the Narayani River at Bhainsalotan is estimated at 170 million tonnes per Year (Sharma 1988).

Table 1: Water and sediment flux of some tributaries of the Ganges River (Sinha and Friend 1994).

River (station)	Upstream catchment area (10 <sup>3</sup> km <sup>2</sup> )	Water flux (10 <sup>9</sup> tons/year)	Sediment flux (10 <sup>6</sup> tons/year)
Gandak (Dumariaghat, India)	43.0	490	82
Kosi (Baltara, India) downstream of the Kosi barrage	88.5	641	43
Bagmati (Hayaghat, India)	13.0	60	11
Burhi Gandaki (Roseru, India)	9.6	86	15
Kamla-Balan (Jhanjharpur, India)	2.9	26	8
<b>Total</b>	<b>157.0</b>	<b>1303</b>	<b>159</b>

Table 2: Annual Sediment load at Barahakshetra and Baltara (RONAST/CWRS 1994)

Location	Annual sediment load (in million tons)			
	Coarse	Medium	Fine	Total
Barahakshetra	26.97	35.78	79.67	142.42
Baltara (downstream of the Kosi Barrage)	7.05	17.04	61.93	86.02

Table 3: The annual sediment load and sediment yield of the tributaries to the Kosi River (RONAST/CWRC 1994).

Tributary	Annual sediment load ( $\times 10^6$ tons)	Annual sediment yield (tons/km <sup>2</sup> /year)
San Kosi	119.24	6199.6
Arun	76.12	2083.4
Tamur	65.12	11035.2
Total	260.48	19318.2

### EROSION RATE IN NEPAL

In recent years, some relatively smaller watersheds in the Lesser Himalaya of Nepal have been taken for more detailed and long-term study in order to provide more realistic data on estimation of sediment yield. These studies have shown that a great number of factors affect rate of soil erosion in these mountainous terrain and the sediment yield could vary greatly in space and time. The average sediment yield in the Kulekhani watershed in central Nepal, south-west of Kathmandu valley, is estimated to be 1,800 tons/km<sup>2</sup>/year (1,200 m<sup>3</sup>/km<sup>2</sup>/year). But the value could jump to as much as 47,550 tons/km<sup>2</sup>/per flood or 31,700 m<sup>3</sup>/km<sup>2</sup>/per flood (Galay et al. 1995). This value is much greater than the design value that was taken for the Kulekhani Hydropower project. Now, the dead storage zone of the reservoir is nearly filled by the sediment within less than 20 years of its existence. In the Phewa Lake watershed in the valley of Pokhara in western Nepal, the sediment yield is over 2,550 tons/km<sup>2</sup>/year (1700 m<sup>3</sup>/year/km<sup>2</sup>) and the Phewa Lake is estimated to be filled in just within a few decades (Sthapit 1995). The Jhiku Khola watershed in central Nepal, shows highly variable surface erosion with potential annual rate of over 4,000 tons/year/km<sup>2</sup> (Carver and Nakarmi 1995).

It is estimated that from its 147,181 sq km of land, 360 million tons/year (240 million cubic meters) of eroded soil is being transported each year by Nepal's four major rivers and over 6,000 tributaries (DSWC 1977; MPFS 1988). It is estimated that the range for soil loss is between 2000-5000 tons/km<sup>2</sup>/year and may increase locally to 20,000-50,000 tons/km<sup>2</sup>/year (DSWC 1977).

The rate of soil erosion depends on many factors including land use and vegetation. Very limited basic research has been done in Nepal on the rate of soil erosion on various types of lands. It has been realised that the decline in soil fertility through soil erosion is one of the major ecological crises facing Nepal today. Laban (1978) did a very rough estimate of soil loss from different land types (Table 4). However, the estimate may include all kinds of mass wasting. Carson (1985) estimates a loss of topsoil in Nepal not to have exceeded 0.5 t/ha.

Table 4: Rate of Soil loss by land use (Laban 1978)

Land use	Annual loss tons/ha
Well managed forest land	5-10
Well managed rice terraces	5-15
Poorly managed sloping terraces	20-100
Degraded range land	10-100

### DEFORESTATION IN NEPAL

#### Forest resources of Nepal

The official estimate of natural forest cover in Nepal as of 1986 is just over 5.5 million hectares which makes up to 37% of the total land area (MPFS 1988). Only 11% of the natural forests are in the Terai and High Himal zones, the remaining area is evenly distributed across the Middle Hills and the Siwaliks. Other land categories covering another 15.5% of the total area have good potential for development into forest or pasture. The land under agriculture is about 21 percent. On an average, the population density is 5.7 per hectare of net cultivated land.

From about 6.4 million ha in 1964, the total forest area is estimated to have declined to 5.5 million ha by 1985. It is estimated that about 0.2 million ha of the Terai and Siwaliks forests were cleared through planned settlement and illegal felling between the 1950s and 1985 (NRN 1992). Nepal's total forest bio-mass is about 628 million tons (MPFS 1988). Seventy-five percent of the country's energy requirement is met by fuel wood. Per capita annual rural household fuel wood consumption in the hills and Terai is about 708 kg and 689 kg, respectively (MPFS 1988). The forest cover of Nepal is shown in Table 5.

#### Deforestation Trend

A good account of the history of forestry management in Nepal is given by Hobley (1996). A large part of Nepal and virtually, all of the Terai, Dun valleys and the Siwaliks of Nepal were under forest cover until as late as the beginning of 20<sup>th</sup> century. Driven by the ever-increasing demand for forest resources in India, Rana rulers started massive deforestation in Nepal. The end of the Rana rule in 1951 also brought a great change in social and economic arena of the people of Nepal. The new democratic government brought all the land under its control and became subject to tax. In 1957 all the forestland was nationalised. This brought yet another spurt of a large-scale deforestation in the hills of Nepal. The forests so jealously protected by the community or the private were suddenly left unguarded. And, in just four decades, the hills of Nepal witnessed severe deforestation making it one of the most degraded mountain regions of the Himalaya.

The systematic deforestation of the Terai, which was already in progress during the Rana rule also continued, rather more thoroughly, since 1951, and more so from 1957 after the Private Forests Nationalisation Act was introduced. For long, the state revenue heavily depended on the export



Table 5: Forest cover and land suitable for forestry purposes ('000 hectares) (MPFS 1988)

Physiographic zone	Forest	Shrub lands	Grass lands	Non-cultivated land	Total	% of area covered
High Himal	155	67	109	1	332	10
High Mountains	1639	176	364	104	2283	77
Middle Mountains	1811	404	281	601	3097	70
Siwaliks	1438	29	17	53	1537	82
Terai	475	30	58	31	594	28
Total area of Nepal	5518	706	829	789	7842	53
%	70	9	11	10	100	

Table 6: Changes in area of forested lands and shrublands between 1964 and 1979 ('000 ha) (MPFS 1988)

Physiographic Zone	1964/65*	1978/79**	Difference	% change	
				1964-1979	Annual
Siwaliks	1739	1476	-263	-15.1	-1.1
Terai	784	593	-191	-24.4	-1.8
Total forest cover in Nepal	6689	6307	-382	-5.7	-0.4

\* Data calculated by Water and Energy Commission Secretariat, HMG/Nepal

\*\* Data calculated by Land Resources Mapping Project, HMG/Nepal

of forest products. As a result, the rapid deforestation in the Terai, Dun Valleys and Siwaliks continued unabated. The changes in area of forest land and shrublands between 1964 and 1979 is shown in Table 6.

It is estimated that a total of 103,968 ha of forest in the Siwaliks and Terai were cleared under the Ministry of Forest and Soil Conservation from 1950s to 1985. About 22,700 ha of the forestlands were cleared only from 1978 to 1985. It is also estimated that an equal area was lost due to the illegal settlements during this period (MPFS 1988).

The repeated systematic surveys based on airphotos taken at different times clearly show that Nepal suffered the most severe deforestation in the last thirty to forty years and the trend continues at present. The population has increased more than three-fold during the same period. Everywhere in the hills and plains, an obvious pressure on the forest cover can be observed. The decline or stagnant food production in Nepal is well documented for the last several years despite the increase of actual agriculture land area as a result of deforestation. Most of the riverbed levels in the plains have been constantly rising. Presently, over 60 percent of the Nepalese people live under poverty line.

#### EFFECT OF DEFORESTATION IN THE HIMALAYAN ENVIRONMENT

A difficult question now is what will be the effect of this extreme deforestation in Nepal. Will the hills of Nepal ultimately convert itself into a wet desert (Thomson and

Warburton 1988). The answer is difficult and uncertain. But, it is logical to argue that forest acts as the most effective and important agent for soil erosion control. As discussed above, even the geological history tends to support the idea that vegetation cover may have been a factor in controlling soil erosion rates in the Himalaya in the past. The reduced erosion rate between 7.4 to 1 million years (coinciding with the intensification of monsoon) may be well taken for increased vegetation cover in the Himalaya. High soil erosion rate is characteristics of the Himalayan region and this has been going on throughout its geological history, but we do not really know how the deforested Himalaya will react to this high rate of soil erosion. We can but certainly predict a overall deterioration of such deforested mountain in a monsoon-dominated climate. Unless more systematic and long-term research is carried out, it is hard to conclusively project the exact nature and extent of the problem.

#### DISCUSSION

There is a consensus among most researchers that the Himalayan environment is degrading due to the high rates of erosion and deforestation. Deforestation in recent decades has positively exposed the Himalayan terrain towards a higher rate of erosion. It is a sick mountain and is heading towards an uncertain destiny. Can we avert or delay this disaster in some way or the other is the main concern to the researchers and policy makers. No definite answer may be available at this stage. But identifying the problem and more precisely evaluating its potential damage in advance can definitely help to mitigate the disaster.

It was long before that the hills of Nepal failed to support its population at the subsistence level. It is the high rate of migration of hill people within and outside the country that delayed the environmental disaster in Nepal. Since the last three decades, the room for migration from hills to other parts of the country and to neighbouring countries is very limited. The ever-increasing population (2.6% per annum, one of the highest in the world), doubling every 27 years, has actually accelerated the environmental degradation in the last three to four decades. The rapid population growth in the next three to four decades will be instrumental to bring the hills of Nepal to more nearer to the environmental disaster. Drastic reduction in population growth, increasing forest coverage, reducing soil erosion, may avert or at best postpone the approaching disaster. But this needs careful planning, adequate research, matching fund and proper implementation of programmes.

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## Engineering geological database for GIS-based landslide hazard mapping

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### INTRODUCTION

There are several methods that can be applied for construction of an engineering geological database for landslide hazard mapping. The most used method is to interpolate between existing boreholes in an area. However, when boreholes are scarce, or the terrain is very heterogeneous, this is not a good situation. In such situations, geomorphic information could be used and an engineering geological database can be constructed by logical reasoning (Van Westen 1997). This paper presents a relational engineering geological database required for common landslide hazard mapping.

### HAZARD MAPPING

Hazard mapping is carried out in different scales and by various methods to produce sets of maps that show different levels of natural hazard. Table 1 shows general trends of landslide hazard zonation methods.

### ENGINEERING GEOLOGICAL DATA BASE

#### Digital Terrain Model (DTM)

DTM refers to terrain features in digital format that can be derived from the elevation data. Terrain information or topographic features can be extracted from DEM (Shrestha et al. 1999). A DEM (digital elevation model) is a digital

representation of a topographic surface with the elevation or ground height above any geodetic datum. Figure 1 shows three major DEMs that are widely used in GIS. Figure 2 is an example of DEM created through the interpolation of contour lines.

Figure 3 shows several terrain features useful for landslide hazard analysis in GIS.

- Slope and Aspect
- Drainage network
- Catchment area
- Shading
- Shadow
- Slope stability

#### Material Maps

The material map is prepared according to the so-called sequence method. The sequence method considers all the material sequences in the area as standard sequences. The standard sequences are the result of the statistical analysis of the sampling points, which have been obtained during fieldwork.

The main materials of study area can be broadly categorized in two types: soils and rocks. The material types can also be differentiated according to geology (Figure 4), or without a specification of which lithology they are, for

Table 1: General trends of landslide hazard zonation methods

Types of landslide hazard analysis	Main Characteristics
A. Distribution analysis	Direct mapping of mass movement features resulting in a map which gives information only for those sites where landslides have occurred in the past
B. Qualitative analysis	Direct or semi-direct methods in which the geomorphological map is renumbered to a hazard map, or in which several maps are combined into one using subjective decision rules, based on the experience of the earth scientist
C. Statistical analysis	Indirect methods in which parameters are used to obtain predictions of the mass movement hazard from a number of parameter maps
D. Deterministic analysis	Indirect methods in which parameters are combined in slope stability calculations
E. Landslide frequency analysis	Indirect methods in which earthquake and/or rainfall records or hydrological models are used for correlation with known landslide dates, to obtain threshold values with a certain frequency



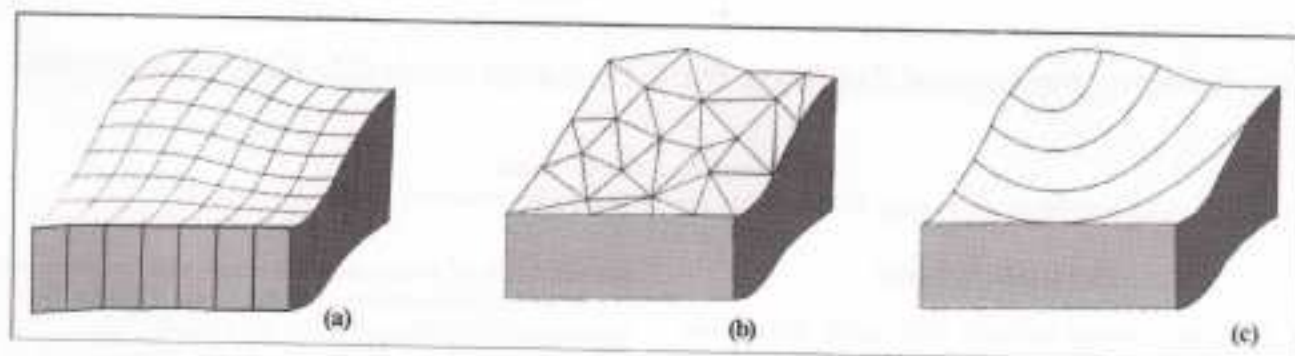


Fig. 1: Digital Elevation Models: a) Grid Cell DEM b) Triangulated Irregular Network (TIN) c) Contour lines

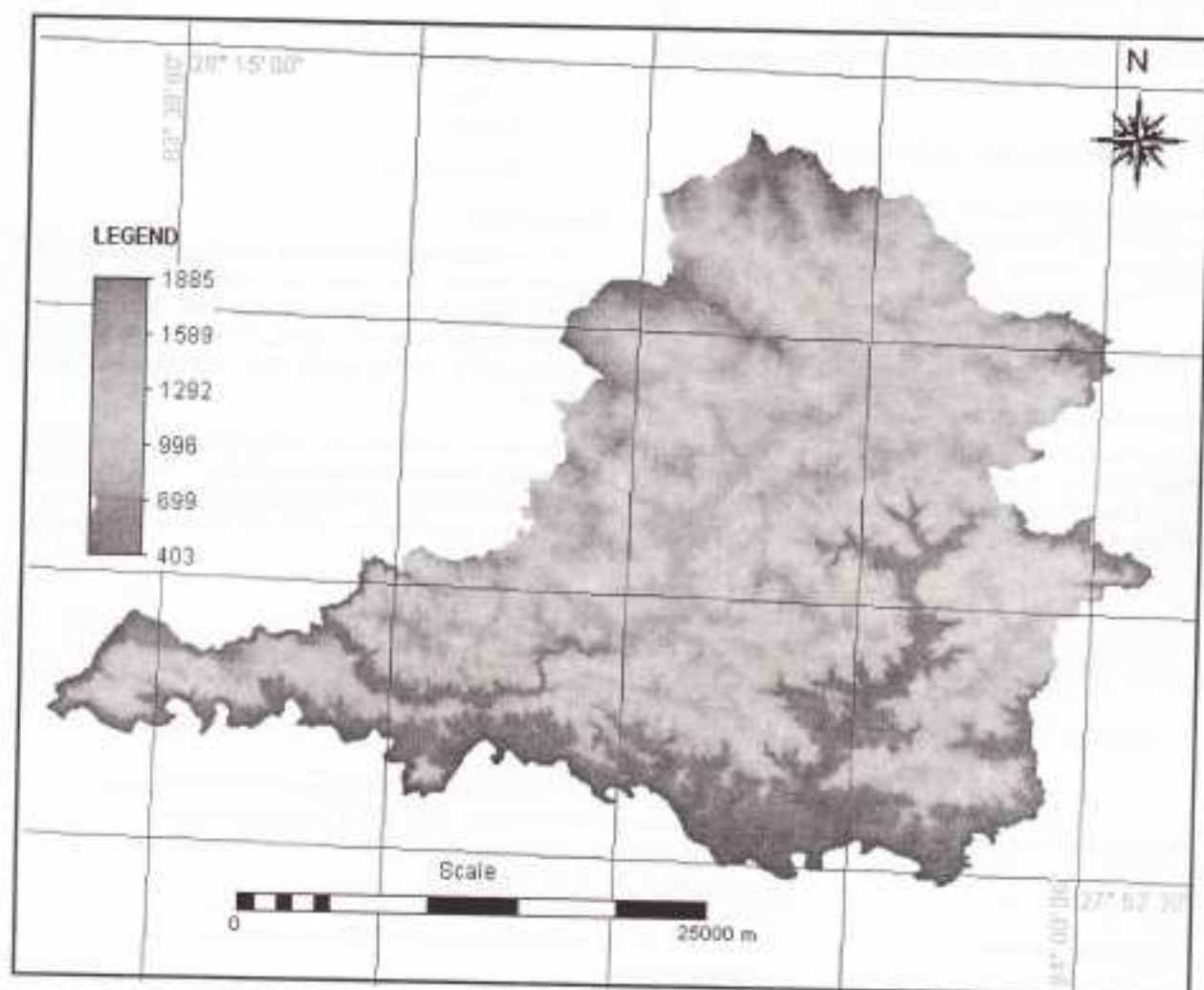


Fig. 2: Digital elevation model of Syangja district (Dangol et al. 2001)

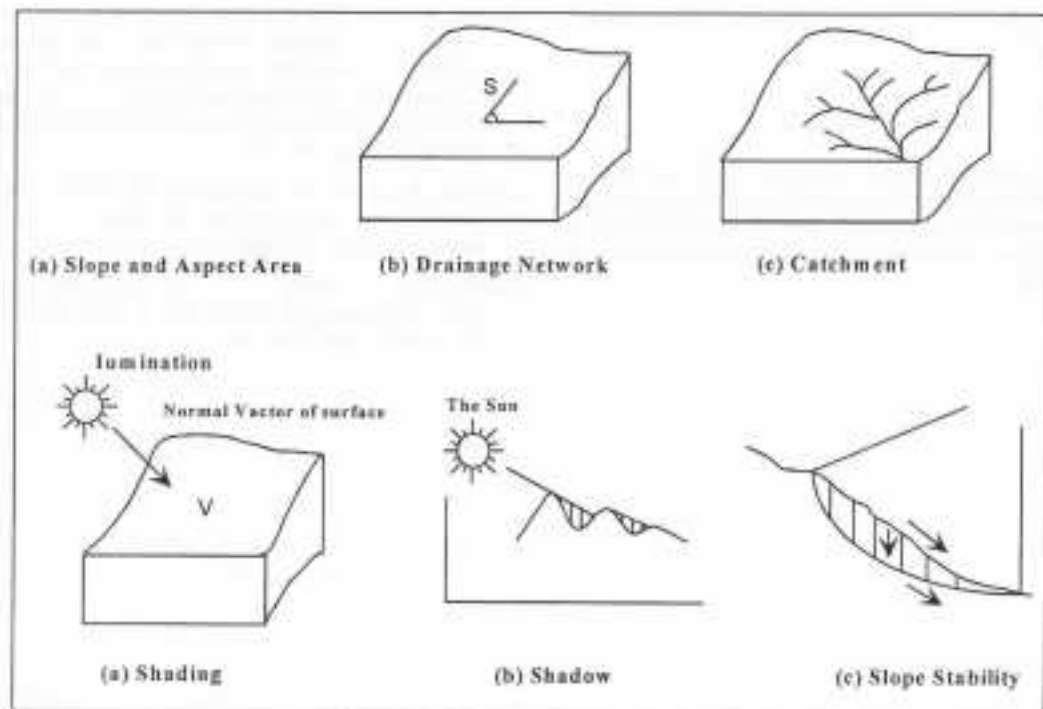


Fig. 3: Digital Terrain Models

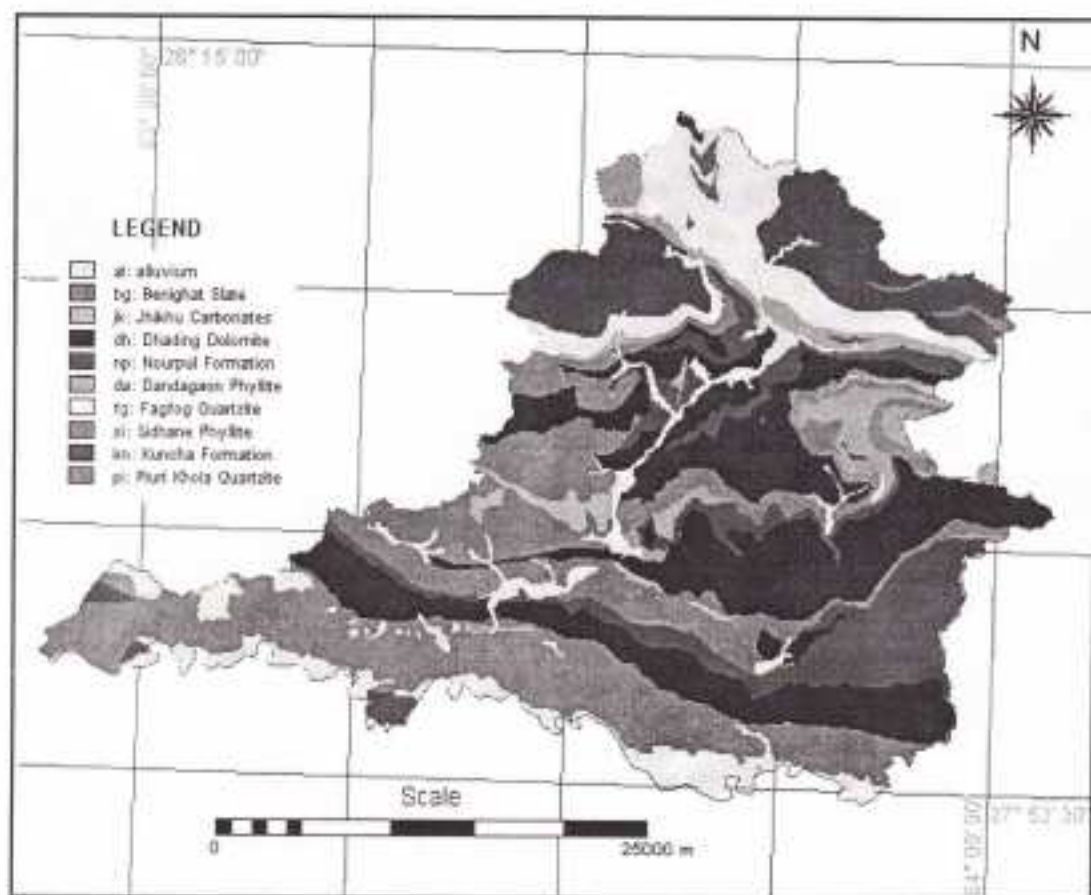


Fig. 4: Geological map of Syangja district (Dangol 2002)



example as "Residual soil", "Weathered rock", "Fresh rock", "Slope deposits"

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## **Geo-chemical characteristics of gneiss of the Gosainkund Crystalline Nappe, central Nepal Himalaya**

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### **ABSTRACT**

The amphibolite to granulite facies rocks of the Gosainkund Crystalline Nappe in the Gosainkund-Sheopuri region correspond to the rocks of the Higher Himalayan Crystallines, which thrust over the greenschist-lower amphibolite facies rocks of the Lesser Himalaya (LH) along the Main Central Thrust (MCT). The aim of this paper is to present the geo-chemical characteristics of the paragneiss of the Gosainkund Crystalline Nappe (GCN) and discuss its origin. The geo-chemical and petrographic characteristics of the paragneiss reveal its sedimentary origin, essentially of pelitic to arkosic trend.

### **INTRODUCTION**

The collision between the Indian and the Eurasian continents in the Eocene time resulted in the formation of the Himalaya. Due to continued movement of the northern edge of the Indian crust, north dipping intra-continental thrust systems are developed dividing the Himalaya into different tectonic units (Gansser 1964). The Higher Himalayan Crystallines (HHC) constitutes of amphibolite- to granulite-facies rocks and is succeeded upward by the Cambro-Ordovician to Eocene Tethyan Sedimentary Series (TSS), separated by a normal fault known as the South Tibetan Detachment System (STDS) (Burg et al. 1984; Burchfiel and Royden 1985; Pêcher 1991). Further south, the HHC thrust over the greenschist- lower amphibolite facies rocks of the Lesser Himalaya along the Main Central Thrust (MCT). The Lesser Himalaya thrusts over the Mio-Pleistocene Siwalik rocks of the foreland basin along the Main Boundary Thrust (MBT). The youngest and the southernmost thrust known as the Himalayan Frontal Thrust (HFT) of the Himalaya forms the boundary between the Quaternary sediments of the Indo-Gangatic plain and the Siwalik Range. The area under this study is bounded in between the longitude of 85°00' and 85°45', and latitude of 27°40' and 28°10' (Fig. 1). The purpose of this study is to show the geo-chemical characteristics of paragneiss of the Gosainkund Crystalline Nappe and discuss its origin.

### **GEOLOGICAL SETTING**

The Gosainkund Crystalline Nappe (GCN) corresponds to the southward prolongation of the Higher Himalayan Crystallines (HHC), which thrust over the Lesser Himalaya (LH) along the Main Central Thrust (MCT) (Rai et al 1997; Rai et al 1998; Rai 1998, 2001).

The GCN consists of the amphibolite to granulite facies rocks. The main rock types are paragneiss, banded gneiss,

micaschist, orthogneiss (augen gneiss, granitic gneiss), migmatite, calc-silicate gneiss, schist, marble and quartzite (Fig. 1). The basal and middle section of the nappe is essentially composed of paragneiss, while the upper section is represented by the calc-silicate gneiss, orthogneiss (augen gneiss, granitic gneiss), migmatite with pelitic and psammatic intercalation, quartzite and micaschist. The paragneiss are also exposed in the upper section where sillimanite is present (Rai et al. 1997; Rai 1998, 2001). The rocks representing structurally an upper level sequence, also contain secondary sillimanite associated with NNW normal ductile shear planes. This could be related to the South Tibetan Detachment System (STDS). The rocks exposed in the lower sections of GCN contain kyanite-garnet-mica assemblages.

In the southern part of the GCN, the global principal structure corresponds to an anticline called as Likhu Khola antiform which is parallel to the Gorkha-Kuncho Anticlinorium (Arita et al. 1973; Pêcher 1978). This fold represents the MCT-drag antiform showing the antisymmetric pattern developed at the frontal part of the nappe. The dips of this antiform to south are steeper than the dips to north (Rai 2001). In the northern sector of the nappe, NE-SW oriented syncline fold is recorded, related to the post-metamorphic deformations.

### **PETROGRAPHY**

Mentioned above, the GCN consists of the different rock types. However, the petrography of the paragneiss is under the discussion. The paragneiss/banded gneiss is medium grained rock containing an assemblage of quartz + plagioclase + muscovite + potassium feldspar and accessory minerals: tourmaline, rutile, Fe-Ti oxides, zircon and apatite. Biotite, garnet, staurolite, kyanite and sillimanite are the metamorphic minerals. On the lower section of the GCN, garnet and kyanite bearing paragneiss (amphibolite facies) are exposed without potassium feldspar while paragneiss



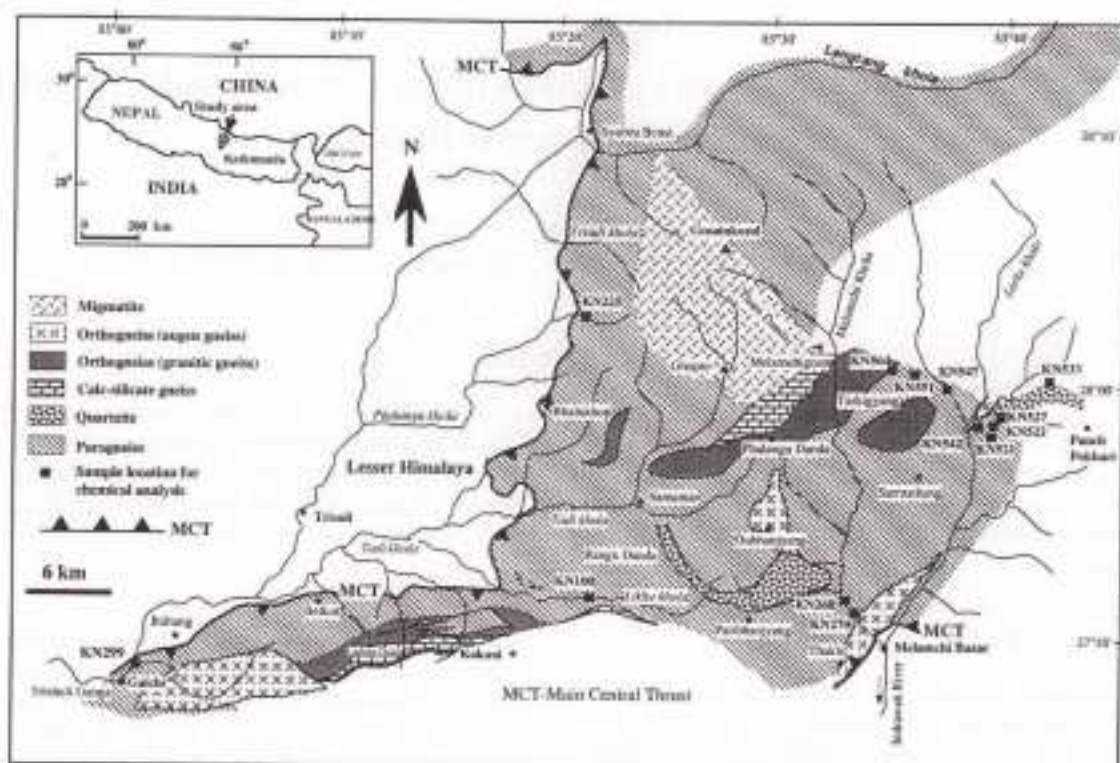


Fig. 1: Geological map of the Gosainkund Crystalline Nappe (Rai 1998). MCT: Main Central Thrust.

containing sillimanite, K-feldspar are found on the upper section. This mineral assemblage is similar to the mineral assemblage described in Formation I of the HHC between the Manaslu and the Dhaulagiri massif (e.g. Colchen et al. 1980, 1986; Le Fort et al. 1986; Vannay and Hodges, 1996). The main foliation is defined by the preferred orientation of euhedral to subhedral biotite, muscovite, potassium feldspar, sillimanite and kyanite.

The anhedral to euhedral garnet is millimetric to centimetric in size. Under microscope, morphologically two types of garnet are observed: the first type garnets show the inclusion of quartz, biotite, muscovite, plagioclase, rarely tourmaline, rutile and opaques in the core and poor in inclusion in its rim. The second type garnets are smaller in size than the first type but these are without inclusions of the other minerals. Sometimes, the garnet crystals show the retrograde metamorphism characterised by the conversion to chlorite found in the upper section of the GCN. Blue, elongated kyanite in the field observation ranges its size up to 2 cm long and it is generally observed in all sections associated with garnet. These crystals under microscope are euhedral to subhedral in shape. They occasionally contain inclusions of biotite and quartz. They are associated with biotite and muscovite in the foliation plane. Centrimetric sillimanite are generally observed in the upper section of nappe. These are fibrolitic in nature associated occasionally with kyanite and garnet. These are generally aligned along the foliation plane. Plagioclase crystals in microscope are euhedral to subhedral in shape with biotite and Fe-Ti oxides

as inclusions. They also show occasional alteration in their margins. Potassium feldspar crystals are present in some samples with an anhedral shape and are generally associated with the biotite. Quartz crystals are anhedral and show undulose extinction.

## GEO-CHEMICAL CHARACTERISTICS

Thirteen rock samples of paragneiss (KN100, KN225, KN268, KN270, KN299, KN521, KN522, KN527, KN533, KN542, KN547, KN551 and KN564) were collected from the different sections of the GCN (Fig. 1). The sample KN225 has been collected from garnet isograd metamorphic rock while the samples (KN100, KN268, KN270, KN299, KN521, KN522, KN527 and KN542) are collected from the kyanite isograd metamorphic rocks. Other four samples (KN533, KN547, KN551 and KN564) have been collected from the sillimanite isograd paragneiss. No metagraywacke sample has been analysed from the study area.

The chemical analyses of the samples were carried out by XRF at Geo-Science Laboratory, Islamabad, Pakistan and emission spectrometry method at CRPG, Nancy, France. The chemical compositions of these samples have been reported in Table 1.

The origin (protolith) of the metamorphic rocks is presented in the  $Al_2O_3$ -K -  $Al_2O_3$ -Na diagram (Fig. 2a; La Roche 1968). The diagram is represented by the parameters  $Al_2O_3$ -K along the Y axis and  $Al_2O_3$ -Na along the X axis, calculated in

Table 1: Chemical and mineralogical composition of the paragneiss and banded gneiss from the Gosainkund Crystalline Nappe

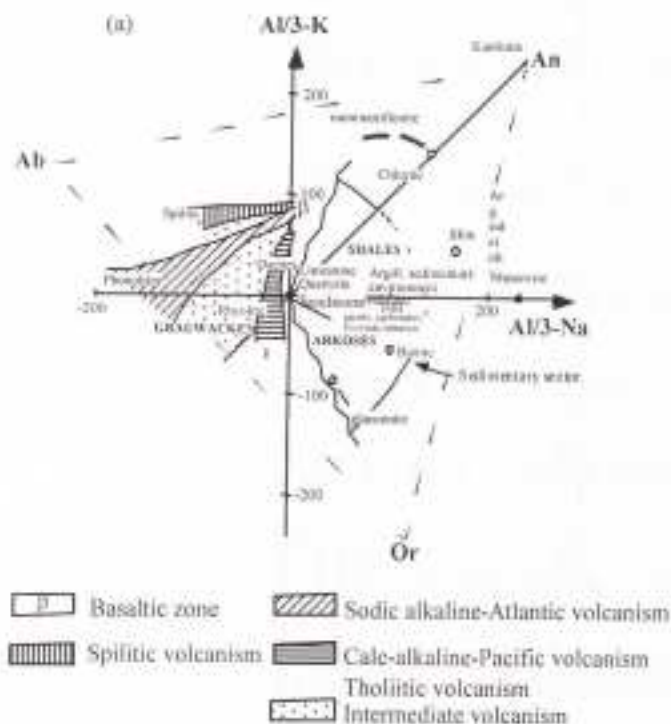
Rock type	Paragneiss						Banded gneiss							
Sample Number	K1270	K1299	K12513	K1247	Average $\pm 1$ sigma	K12468	K12521	K12522	K12527	K12542	K12551	K12564	Average $\pm 1$ sigma	
Location	Padangu Khola	Melanchi Khola	Kalpu Khola	Panch Pokh, Ban Khola	Tadi Khola, Ban Khola	Tadi Khola, Melanchi Khola	Boetung	Bhotang	Panch Pokh, Ban Khola	Panch Pokh, Ban Khola	Tangri, Danda	Tangri-glyang		
SiO <sub>2</sub>	67.35	61.23	69.84	66.69	69.06	65.36	76.44	71.86	70.45	75.44	62.07	66.99	69.37	
Al <sub>2</sub> O <sub>3</sub>	16.42	18.16	13.48	15.9	15.85	15.17	12.36	13.77	15.40	12.41	17.31	14.34	14.44	
Fe <sub>2</sub> O <sub>3</sub>	5.5	6.67	5.47	6.12	5.95	5.87	3.81	5.28	4.39	4.68	7.35	7.59	5.65	
MnO	0.07	0.05	0.07	0.03	0.10	0.06	0.08	0.07	0.06	0.07	0.10	0.03	0.07	
MgO	1.4	2.36	2.79	2.27	2.04	2.26	1.86	1.02	1.19	1.08	2.60	2.39	1.71	
CaO	8.47	2.72	2.02	0.38	1.26	3.32	2.62	0.65	0.87	0.54	1.90	1.06	1.33	
Na <sub>2</sub> O	1.44	2.59	2.13	0.06	1.42	2.41	1.75	0.23	2.12	0.87	3.33	1.68	1.80	
K <sub>2</sub> O	4.53	4.01	2.79	5.69	4.17	3.91	4.33	3.44	3.83	3.40	3.37	4.52	3.88	
TiO <sub>2</sub>	0.72	0.92	0.66	0.82	0.76	0.66	0.60	0.80	0.47	0.55	0.90	0.95	0.75	
P <sub>2</sub> O <sub>5</sub>	0.80	0.16	0.13	0.13	0.25	0.17	0.34	0.06	0.83	0.05	0.12	0.15	0.14	
Loss	2.04	1.14	0.64	1.78	1.41	1.25	0.92	1.44	1.22	1.19	0.94	0.58	1.12	
Total	100.72	100.01	100.00	100.01	100.15	99.66	100.46	100.01	100.00	100.00	99.99	100.83	100.22	
Q	218	131	232	224	212	168	161	278	230	111	147	109	129	
P	65	32	34	135	37	30	11	63	30	53	46	46	40	
A	251	58	42	155	142	26	2	124	112	117	79	79	81	
B	321	165	154	153	127	151	88	121	96	99	170	178	130	
Na+K	148	104	123	145	118	157	163	114	147	99	166	150	136	
K/(Na+K)	0.76	0.61	0.57	0.99	0.81	0.82	0.73	0.83	0.64	0.83	0.50	0.75	0.50	
Mg/(Mg+Fe)	0.34	0.41	0.50	0.42	0.40	0.45	0.37	0.25	0.35	0.31	0.41	0.30	0.37	
Q%	30.20	50.40	41.805	40.40	44.00	30.20	29.10	40.30	41.40	56.00	26.50	36.00	40.00	
B%	21.60	23.60	27.70	27.60	25.00	27.20	16.00	21.90	17.30	17.00	32.00	32.00	22.00	
P%	38.00	46.70	30.50	31.00	36.00	42.60	44.90	28.00	41.30	26.20	41.30	31.10	35.30	

Analyses by GCF at GeoScience Laboratory, Islamabad, Pakistan; cross-correlated K12100 (Gemsam) microprobe, CHS, Naive, Fesam4

Analyses by XRF at Geoscience Laboratory, Islamabad, Pakistan except sample K1010 (emission spectrometry, CERG, Nancy, France)



the gram-atoms  $\times 10^3$  in 100 gram of the rock or mineral. This diagram is used to represent the parent rock (origin) as igneous or sedimentary for metamorphic rocks. Al, Na and K are the major elements to represent this diagram. The chemical compositions of paragneiss of the GCN have been plotted in the  $Al/3-K - Al/3-Na$  diagram. The compositions of all analyzed rocks fall in the sector of the sedimentary rocks, i.e., shale and arkose (Fig. 2b).



A slightly modified diagram (Fig. 3a; Moine and La Roche 1968) is very often used in the study of Formation I rocks of the Tibetan Slab (Higher Himalayan Crystallines), central Nepal (Pécher 1978; France-Lanord 1987; Brouand 1989). This modified diagram representing Fe, Ti and Al element is distinguished from the diagram of La Roche (1968, 1972) (Fig. 2a). The chemical compositions of paragneiss plotted in the  $(Al+Fe+Ti)/K - (Al+Fe+Ti)/Na$  fall in the fields of shale and argillaceous carbonate rocks (Fig. 3b). The samples

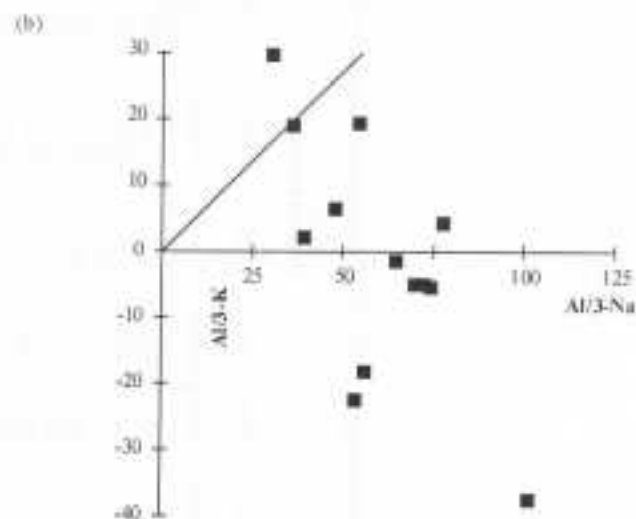


Fig. 2: Distribution of the chemical composition of the paragneiss of the Gosainkund Crystalline Nappe on the  $Al/3-N - Al/3-K$  diagram of La Roche (1968). Parameters are calculated in gram-atoms  $\times 10^3$  in 100 gm of rock or mineral. This diagram shows a good discrimination between the igneous and sedimentary rocks.

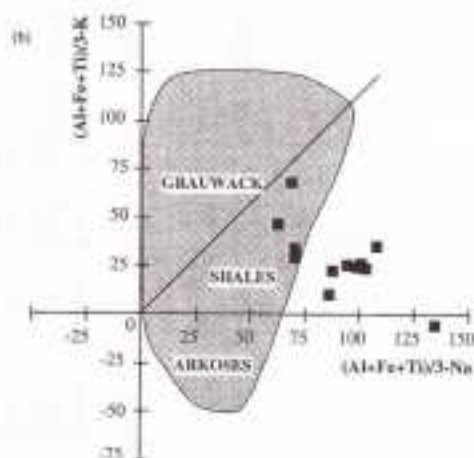
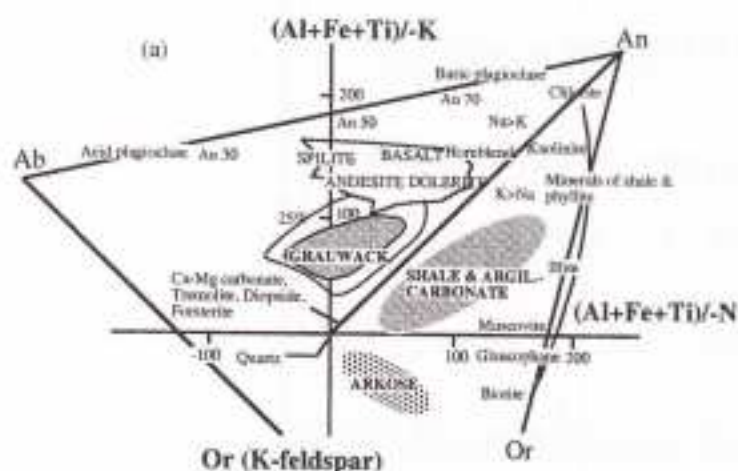


Fig. 3: Distribution of the chemical compositions of the paragneiss of the Gosainkund Crystalline Nappe on the  $(Al+Fe+Ti)/3-Na - (Al+Fe+Ti)/3-K$  diagram of Moine and La Roche (1968). For comparison, shaded zone is represented by the samples of the Formation I of the Tibetan Slab (Higher Himalayan Crystalline), Manaslu region, central Nepal (France-Lanord, 1987).



(KN299, KN521, KN522, KN527 and KN542) show more quartz-feldspathic nature. More quartz-feldspathic assemblages in paragneiss probably correspond to the older gneiss-pelitic rocks. More pelitic rocks contain abundance of biotites and  $K_2O$  content (%) in their bulk composition (Table 1). The rocks of the GCN consist of the alternation of quartzose gneiss and more micaceous gneiss, which probably correspond to older alternation of gneiss and pelitic rocks with minor association of the carbonate rocks. As compared to the rocks of Formation I of the Tibetan Slab in the Manaslu region (shaded zone in figure 3b), studied by France-Lanord (1987), the composition of the gneiss of the Gosainkund Crystalline Nappe is principally concentrated to the pelitic pole and partially in the gneiss pole (Fig. 3b). The metagneiss (quartzose gneiss) sample contains high content of  $SiO_2$ , while  $Al_2O_3$ ,  $Fe_2O_3$ ,  $K_2O$  contents are rich in the metapelitic sample (micaceous gneiss) (Table 1: Samples NA410 and NS411 of the Formation I of the Tibetan Slab (Colchen et al. 1986).

## CONCLUSION

The geo-chemical and petrographic characteristics of paragneiss from the Gosainkund Crystalline Nappe confirm that the gneiss is of sedimentary origin, essentially pelitic and tends to arkose. The rocks consist of the alternation of quartzose gneiss and more micaceous gneiss, which probably correspond to older alternation of gneiss and pelitic rocks with minor association of the carbonate rocks.

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## **Harvesting roof water for livelihood improvement: A case study of the Yarsha Khola Watershed, eastern Nepal**

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### **ABSTRACT**

The roof water collection technology for the purpose of ensuring safe and reliable drinking water-supply to rural households was introduced in the Yarsha Khola watershed, Dolakha district of Nepal in 2000. Communities residing along the water divides, elevated terraces, hilltops, and spurs, face chronic water shortage particularly during the dry season. The traditional water sources, namely, dug-out ponds, springs, seepage, shallow well, and streamlets dry out soon after the offset of monsoon. Piped water to the scattered households is not cost effective due to wrong geographical location and long distance from water sources. Therefore, harvesting of roof water in ferro-cement jar was chosen as a viable option to meet this challenge, because the average annual rainfall is substantial. Formal practical training was provided to selected local masons, who installed several water harvesting jar sets on farmer's house yard and school premises.

A preliminary assessment of the intervention, indicated that the majority of respondents had positive impression about the technology, because it saved water fetching time, provided convenience particularly to the aged people who prefer to avoid slippery trail during rainy season, and supplied cool and clear water from the jar. Although it is highly accepted, initial high investment restricts majority of poor rural farmers access to this technique.

The paper describes the management aspects of water harvesting technique, detail of the materials required, and role local authorities for institutional strengthening to ensure access to safe and the independent water-supply to the desperate rural household.

### **INTRODUCTION**

Improved and reliable access to water is amongst the most pressing needs of poor people in all countries of the Hindu Kush-Himalayan region. Adequate supply of clean and safe water is crucial to health and well being of the people. At the same time access to adequate water-supply for irrigation is important to ensure the livelihoods of the people. Demand for water rises continuously due to increasing population and expansion of irrigated areas. Continued reliance upon the traditional water sources, such as springs, seepage, small dug out ponds and streamlets on one hand and the water resources management, such as construction of dams and exploitation of new aquifers to increase supply on the other, is often no longer a sustainable option. New approaches in water management and improved water use are increasingly recognised to be a more appropriate strategy. Management and harvesting of rainwater play an important role in this strategy. For example, the Rural Water-Supply and Sanitation Support Programme (RWSSSP), which is jointly funded by the Government of Finland and His Majesty's Government of Nepal, successfully improved the water availability for poor rural communities in the water deficit districts of western Nepal (Arghakhanchi, Gulmi, Kapilvastu, Nawalparasi, Palpa, Parbat, and Rupandehi) through roof water collection techniques. The residents in areas along the divides, hilltops, spurs, and elevated terraces with poor access to traditional

sources, are increasingly suffering from chronic water shortage as pointed out by a study in the Middle Mountains of Nepal (Merz and Nakarmi 2001). Moreover, provision of gravity water-supply in most cases is not possible owing to high cost. Collection and storage of rainwater has been considered an appropriate alternative in areas with adequate annual rainfall exceeding 500 mm to ensure reliable water-supply to the isolated households scattered in the mountain landscape.

In this paper the roof water harvesting approach introduced in the Yarsha Khola watershed and the perception of the beneficiaries on the new technology are described. The project funded by the Kirchgemeinde Zuz, Switzerland, and the community support fund of the People and Resource Dynamics of Mountain Watersheds in the Hindu Kush-Himalayas Project (PARDYP) of the International Centre for Integrated Mountain Development (ICIMOD) supported the efforts of the local masons who were lately trained in the construction of ferro-cement rainwater harvesting units for rural conditions. The enthusiastic local masons took keen interest and leadership to test and demonstrate their newly acquired skill to improve the condition of their village folks. Under the overall technical guidance of PARDYP and close supervision of the Village Development Committee (VDC) officials, they successfully constructed nine units of rainwater harvesting system. The technology is new to the beneficiaries who ranged from a single family, village



development authorities to schoolchildren. There is also a concern over quality of the rainwater collected and stored for sometime in the new jars.

The Yarsha Khola watershed is one of five watersheds, where PARDYP is carrying out research in the fields of watershed and natural resources management. The watershed is located about 190 km east of Kathmandu on the Lamosangu-Jiri Road (Fig. 1). The elevation of the watershed varies from 1000 m to 3000 m with climatic gradation from subtropical humid to cool temperate pre-humid. The average annual rainfall ranges between 1600 mm at lower elevations (southeast) to 3000 mm at the higher parts (northwest). Despite high annual rainfall, farmers face acute water deficit, because a substantial portion of the rain runs off and most of the rain, about 80%, falls during only four months of monsoon.

The population density is about 331 persons per ha with an annual average population growth rate of 2.6 per cent (Shrestha 2000). According to the Nepal Family Health Survey (NFHS, 1991) barely 43% of the rural population has access to water-supply. In the Yarsha Khola watershed many households indicate that they face major problems with their water-supply (Merz et al. 2000). Inadequate water-supply during the late winter and pre-monsoon months and sediment contamination during the wet season are the main constraints according to the survey. Residents of these areas without easy access to running water face the main hardships.

A survey of public water sources (Shrestha et al., 2001), indicated that the traditional water-supply system includes taps, springs, stone spouts, spring boxes (kuwa), wells and rivers sites. The number of households depending on these sources ranged from 1 to 150. In general these sources would provide adequate water-supply to all residents of the Yarsha Khola watershed if they are well managed. However, many sources are far from the settlements and long time is required for water collection. People face major problems to fetch water during the monsoon when the pathways are slippery and dangerous (Sharma 2001).

Therefore it was decided to focus attention at first on collection of rainwater for domestic water-supply. This enables water collection at any convenient location and provides water to the people at convenient location.

### MODUS OPERANDI

Under PARDYP in collaboration with the Water Harvesting Project of ICIMOD and RWSSSP six local masons from four VDCs were trained to construct ferro-cement rainwater harvesting jars. The training included all aspects from site selection equipment, and preparations to final construction and sanitation.

Implementation of some demonstration units was initiated with a first formal meeting attended by the district chairperson, chairmen of four VDCs, six masons and PARDYP

project staff. That meeting decided to construct one roof water collection unit at the premises of the district headquarters in Charikot. This system serves as demonstration unit to the visitors. Second meeting decided to install another eight water harvesting units, two per each VDC. The chairmen from Namdu, Kabre, Mirge, and Gairimudi VDCs in consultation with the trained masons collectively identified two suitable beneficiaries per VDC who were prepared to bear partial cost of NRs 300 in cash to a revolving fund plus sand, gravel and unskilled labour during construction and as well as for transportation of materials (cement, wire, mesh pipes etc.) from the road head to the site of installation. Masons themselves organised the essential items and took full responsibility to complete the entire construction activities. Fig. 1 shows the location of the water harvesting jars constructed in 2000 within the four VDCs of the Yarsha Khola watershed. All these activities were financed by the PARDYP through the support of the Kirchgemeinde Zuoz, Switzerland and the community support fund of PARDYP.

### ROOF WATER HARVESTING SYSTEM

The roof water harvesting system comprises three components:

- Catchment
- Conveyance
- Storage

For the catchment the roof of the house or any building is used. Usually tin sheet roof is recommended. For good water quality the roof has to be frequently cleaned, especially after the long dry period of winter and pre-monsoon. The second component ensures safe conveyance of water from the roof to the storage. This is a gutter system made up of polythene pipe, which is split along the longitudinal section. The gutter pipe has a flushing system to periodically drain

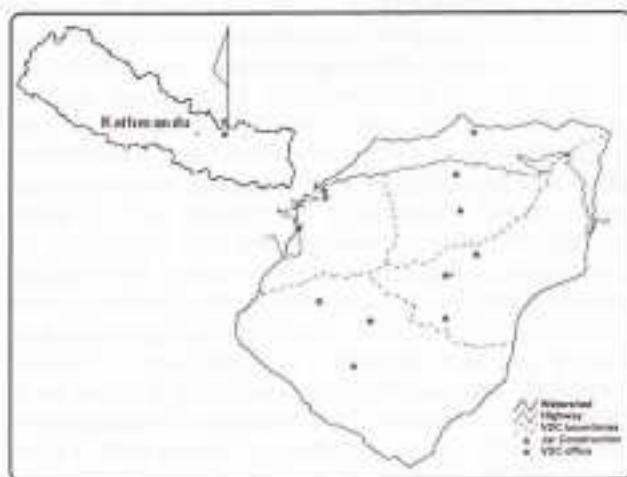


Fig. 1: Location of construction site in Yarsha Khola watershed.



dirty water at the beginning of each rainfall event. The third component is the storage tank, a ferro cement jar of 2000 litre capacity. The opening is covered with fine nylon mesh to check the entry of undesired coarse elements. It is further covered with a tin lid. A tap is fixed about 20 cm above the ground (about the height of a 15 litre local water vessel called *Gagri*) to avoid the collection of too much water at a time. Fig. 2 provides the general view of the first ferro-cement jar constructed by the masons at the premises of the DDC office at Charikot.

For trained masons the installation of the entire system is quite straightforward even under rural conditions. Provided all materials and moulds are available, fabrication of the entire system is completed more or less within a week. More detail information on the jar technology can be found in RWSSSP (2001). Table 1 provides the breakdown of material and labour required for construction of one unit of rainwater harvesting system.

#### Local perception on roof water harvesting units

In total nine water harvesting systems were constructed. They are directly serving four households, two VDC offices, two schools and the district headquarter at Charikot. The intervention has invoked a great deal of interest among local residents and local development authorities to build more units. However, financial considerations have yet obstructed the further construction. Sharma (2001) reported that rain water harvesting in the Jhikhu Khola watershed provided several benefits, particularly reduced female's water fetching time significantly up to a person a day during the wet season.

The construction of eight water harvesting jars in the Yarsha Khola watershed was completed by September 2000. This gave ample opportunity to capture the last monsoon rains. A few months later during March and April a simple interview was conducted with twenty persons including the owners, schoolteachers, VDC officials, and masons regarding the benefits, problems and suggestions for future

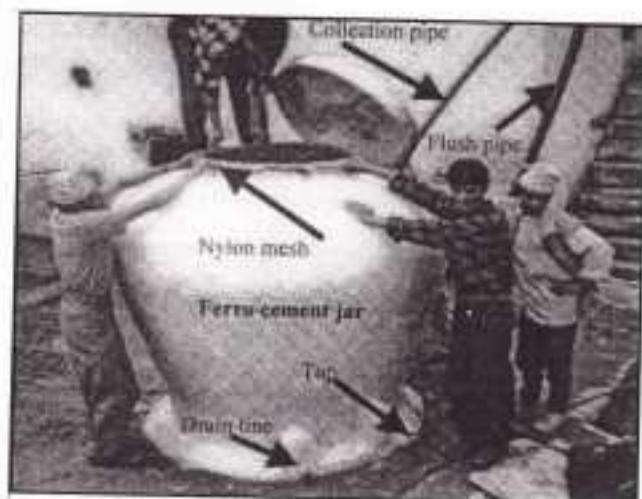


Fig. 2: General overviews of ferro-cement tank in Dolakha.

improvement of the water harvesting systems. Although the experience with the application of the system was short to make substantial judgements, some general feelings and remarks of the respondents are summarised below.

#### Positive aspects

Almost all respondents in general expressed full satisfaction with the technique for several reasons (Fig. 3). Firstly, it helped to avoid risky movement along the slippery trails with pitchers full of water during the rainy periods. The jar technology made water available near the house. Seventy percent of the respondents mentioned that particularly aged folks benefited a lot who had troubles to cover longer distances. Secondly, the water-supply from the jar is convenient. There is no need to wait for a turn as required in many sources during the dry season. Fifty five percent of the respondents mainly beneficiaries reported that the harvesting system has considerably reduced water

Table 1: Breakdown of materials and people required

Item	Quantity
<b>Construction materials</b>	
Cement	4 bags
Coarse sand	0.443 cu m
Fine aggregate (5mm)	0.064 cu m
Chicken wire mesh (22 gauge)	16 m
3.5 mm Ø (10#) G.I. plain wire	7 kg
Metal jar cover	1 nos
Nylon mesh	1.0 m
90 cm width plastic sheet (300 gm / m <sup>2</sup> )	6 m
Binding wire	0.3 kg
Snowcem paint	2 kg
Enamel paint	0.05lt
<b>HDPE pipe gutter</b>	
90mm / 2.5 kgf polyethylene pipe	5 m
63mm / 4 kgf polyethylene pipe	3 m
40 mm / 6 kgf polyethylene pipe	5 m
3" G.I. roofing nail with cap	0.2 kg
3" plain nail	0.2 kg
Metal clamp	5 pcs
Elbow, reducer, tee, end cap	1 each
<b>Fittings</b>	
Brass tap with latches	1 no
½ x 10" G.I. nipple with 6mm rod welded	1 no
1 x 10" G.I. nipple with 6 mm rod welded	1 no
1" end cap	1 no
½ G.I. socket	1 no
Thread seal tape	0.25 roll
<b>Labours</b>	
Skilled	7.5 (day)
Unskilled	7.5 (day)



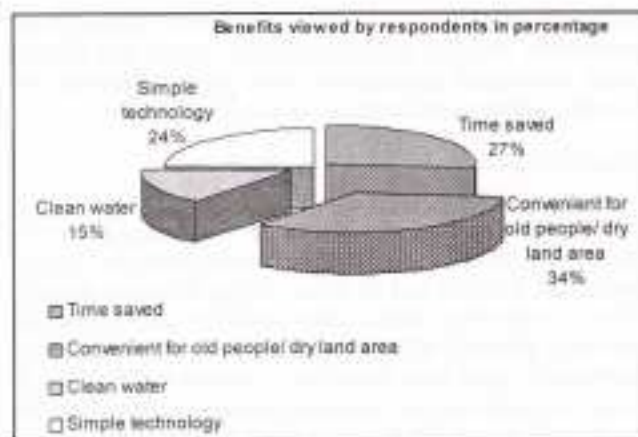


Fig. 3: Public responses on rainwater harvesting system.

collection time, which can now be used for other household work. Thirdly, in the rainy season the water sources, which mostly are unprotected get readily contaminated with various pollutants including sediments, converting drinking water muddy, and aesthetically unfit for human consumption. Thirty percent highlighted that the jar provided clear water. However, it is important to note that for the first ten to fifteen minutes the water collected from the roof has to be flushed not allow it to enter into the storage tank. This water may contain the dirt from the roof. After 15 minutes clear water is allowed to pass into the jar through the plastic mesh. The lid is kept closed all the time to maintain clean conditions. Last but not least, 50 percent of the respondents viewed that the technology is simple and easy to adopt at village level.

#### Constraints

The respondents noticed some constraints in this technology such as the low height of the tap. This is felt to be inconvenient to place larger and taller vessels. However, as mentioned earlier, the tap is intentionally fixed at 20 cm above the bottom of the jar to avoid the collection of too much water at a time. With this setup only small vessels can be used to collect water, which reduces the waste of water. The tap is further kept locked. The tap height can be raised, which means that the dead storage is increased, i.e. more water is unavailable for use. Forty percent wished to raise the tap height (Fig. 4). The experiences from Western Nepal showed that the recommended lower height optimises and effectively controls the water waste. Inconvenience in collection is compromised with extension of water availability for a longer period. In Namdu beneficiaries (10%) mentioned minor leakage from the lower part of the jar. The leakage is attributed to weak supervision of masons during mortar preparation. This implies that technical orientation to the beneficiaries, in presence of masons will help to avoid undesired problems and improve co-operation from all parties involved. The beneficiaries will be able to point out the shortcomings during construction phase and cooperate better. This is an important lesson learnt for the future

improvement. Construction of several units at a given location may also help to reduce the cost per unit. If construction sites are far apart, the work efficiency of masons decreases and consequently unit cost increases.

#### Suggestion for future Improvement

It is obvious that the jar's 2000 l capacity is far below the annual water demand of a family. 50% of respondents expressed the desire to add more jars (Fig. 5), but also expressed the inability to bear the entire cost of the unit. However, the aim of the project was rather to demonstrate the simple water-harvesting technology and to show that the trained local masons are fully capable of fabricating the units in the sense that frequent appearance of external technicians is not required. More jars can be added according to users' financial convenience and water demand.

A jar with water weighs nearly three tons. A stable and solid base is therefore essential to protect the jar from sinking and breaking. 20% of the respondents recommended to further improve the foundation part. This is an important suggestion to be kept in mind. Another point is that a jar can be filled faster by increasing the catchment (roof area). Villagers are so far not used to direct consumption of the rainwater. Uncertainty about the water safety for health is natural and was mentioned by Twenty percent of the respondents. They requested and suggested conducting water quality tests to ensure safety for drinking.

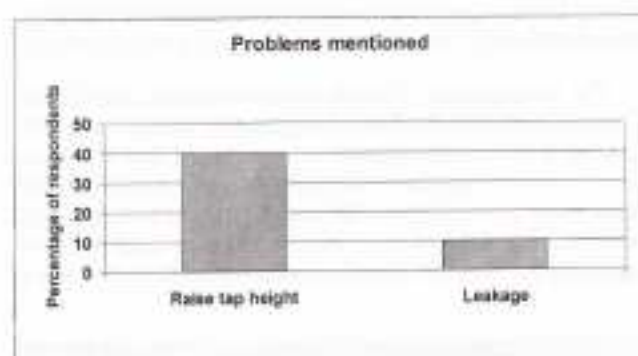


Fig. 4: Problems encountered by respondents on ferro-cement jar.

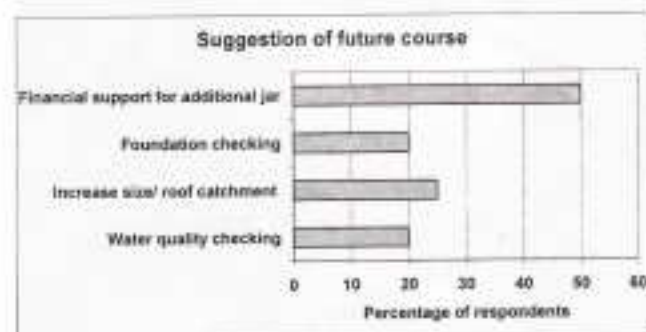


Fig. 5: Respondents suggestions for future activities.

## WATER QUALITY

Under PARDYP water quality tests in the Jhikhu Khola watershed (JKW) were conducted in waters collected in the jars in different seasons. Preliminary results showed that the water quality in the jars is highly depending on the management of the system. In case of poor cleaning of the roof and gutter, water tends to be of bad quality. In order to ensure that water quality does not deteriorate over time series user should frequently keep roof and gutter cleaned and jar is properly covered with lid.

## FUTURE DIRECTION

The recently formed "Yarsha Khola Watershed Jar Construction Committee" has collected cash contributions from each beneficiary (NRs 300 per household) in a fund to be used for the maintenance of the equipment, moulds and initiation of the future construction. Currently neither VDCs nor the DDC has resources for this new technology to implement on a larger scale despite great appreciation by the officials and villagers. At present neither the line agencies is prepared nor the local financial institutions are prepared to invest as they are uncertain about the technology. Construction of a few dozens jars at the sites with acute water shortage would provide opportunity for a larger community to examine the relevance of the new technique, and the word would spread. Involvement of district water-supply officials in these activities would enhance the extension of the introduced activities.

## CONCLUSIONS

The construction of ferro-cement water-harvesting jars gave overall a positive response from the users. Despite of few limitations the technique helps the rural population to access safe water. In addition to safe water, the new technique saves time and prevents disputes common during the dry season. The time saved can be invested in other productive activities. Good water-supply leads to sanitation improvement, which in turn results in the health improvement.

The trained local masons are now fully capable of constructing the ferro-cement water harvesting units. But the construction of limited units in locations far apart increases the unit cost. Initial cost is so high that it is impossible for the rural farmers to bear the entire cost of the system. Moreover, it will take time to change the old mentality of people that water is free of cost. In order to get farmers to implement the construction of jars there is still a lot of work to be done. Ferro-cement jars are durable and cost effective systems in a long-run. The cost may decrease as the technology refines and local workmanship and expertise improve.

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## Status of groundwater in Kathmandu Valley

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Ground Water Resources Development Project (GWRDP)

### BACKGROUND

Kathmandu valley is an intermountain basin which covers an area of about 500 km<sup>2</sup> centered on 27°42'N, 85°22'E. The average altitude of the valley floor is about 1350m above sea level and surrounding hills are 2800m above sea level.

In relation to the groundwater extraction in the Kathmandu valley, Nepal Water Supply Corporation (NWSC) carried out the first ground water extraction in 1970. The tendency was increased to 9 million liter per day (MLD) in 1984, 34 MLD in 1987 and 42 MLD in 1998 and reached to 58.6MLD in 1999 according to ADB's study. Where as Metcalf & Eddy/CEMAT, "Urban Water Supply Reforms in the Kathmandu Valley (2000)" shows the rate of extraction as much as 59.26MLD (out of which 29.17MLD by NWSC & remaining by Hotel/Industries/Institutions). The world Bank (1994) estimated the sustainable ground water extraction rate (yield) is 26.3 MLD which shows the present yield exceeds the optimum extraction by more than two times). The water demand for drinking water for Kathmandu valley at present is 160MLD (Good Governance, Apr-June 2001, Pg. 12).

A report of Metcalf & Eddy/CEMAT Consultant and the ADB as a part of Melanchi Water Supply Project noted that both the static and pumping water level have been depleted in most part of the Kathmandu valley. NPC/IUCN 1995 reported that the ground water level in the valley is lowering at an average rate of 2.5 meter per year. Several countries

(China, Bangkok etc) in the World have experienced that the impact of excessive ground water extraction resulting in land subsidence.

Focusing to those issues, the monitoring of groundwater level in Kathmandu Valley is being performed at present by Groundwater Resources Development Project, Babarmahal as per the agreement between Groundwater Resources Development Project (GWRDP), Department of Irrigation and Melanchi Water Supply Development Board. The monitoring work of groundwater level in Kathmandu Valley was started by GWRDP since March 2000 and it is ongoing to date. It was planned to take groundwater level measurement in fifty representative deep tube wells (DTW) of the Kathmandu Valley. In addition, the GWRDP is also monitoring River Discharge Measurement, Surface Water Quality, Waste Water Quality and Groundwater Quality of Kathmandu Valley under the same agreement.

### FINDINGS

In general, the water level fluctuation in Northern part of the Kathmandu valley (well no. BB-6a, Gongabu) show direct relation to the rainfall. The maximum seasonal water level fluctuation since March 99 to March 2003 (4 hydrologic cycles) is found to be 14 m. The Hydrograph presented in the Fig. 1, shows a natural trend i.e water level goes down in dry season (April/May, pre-monsoon) and rise up in wet season (August/September, post-monsoon). In the 4

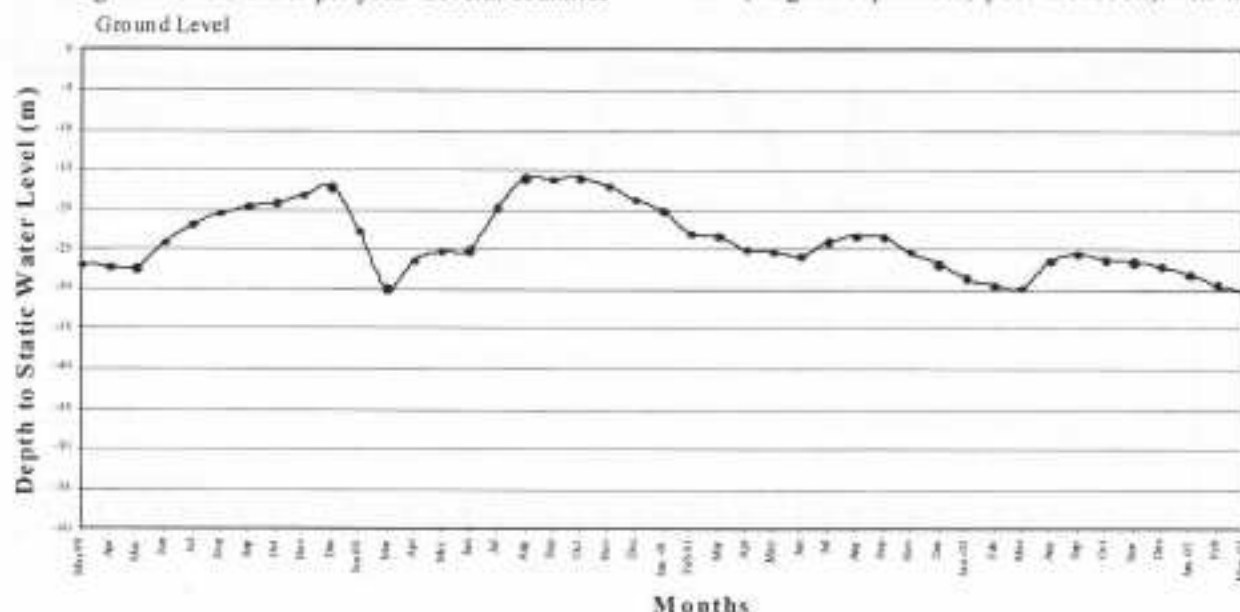


Fig. 1: Fluctuation of Water Level in Northern Part of Kathmandu Valley (BB-6a, Gongabu) (Source: GWRDP).

hydrologic cycles, the maximum depth to water level stayed at nearly same level (i.e. 29.9m below ground level). The hydrograph of the Gongabu, well no. BB-6a, Fig. 1, does not show the decreasing trend of water level in Northern part of the Kathmandu valley.

The hydrograph of Central part of Kathmandu Valley (Well no. G-17, Patan Hospital, Lalitpur, Fig. 2, does not show seasonal fluctuation and it does not show any decreasing trend of ground water level in the 3 hydrologic cycles.

In case of Southern part of Kathmandu valley, the hydrograph of well no. PH-1, Pharping powerhouse is considered. The well is affected by interference of Nepal Water Supply and Sewerage Corporations (NWSC) well. When the NWSC well will be in operation (mainly in dry period), the water level will be decreased to 31.3m bgl and in other periods, the well is found to be artesian, see hydrograph presented in Fig. 3. The hydrograph of this region also does not show any decreasing trend of water level.

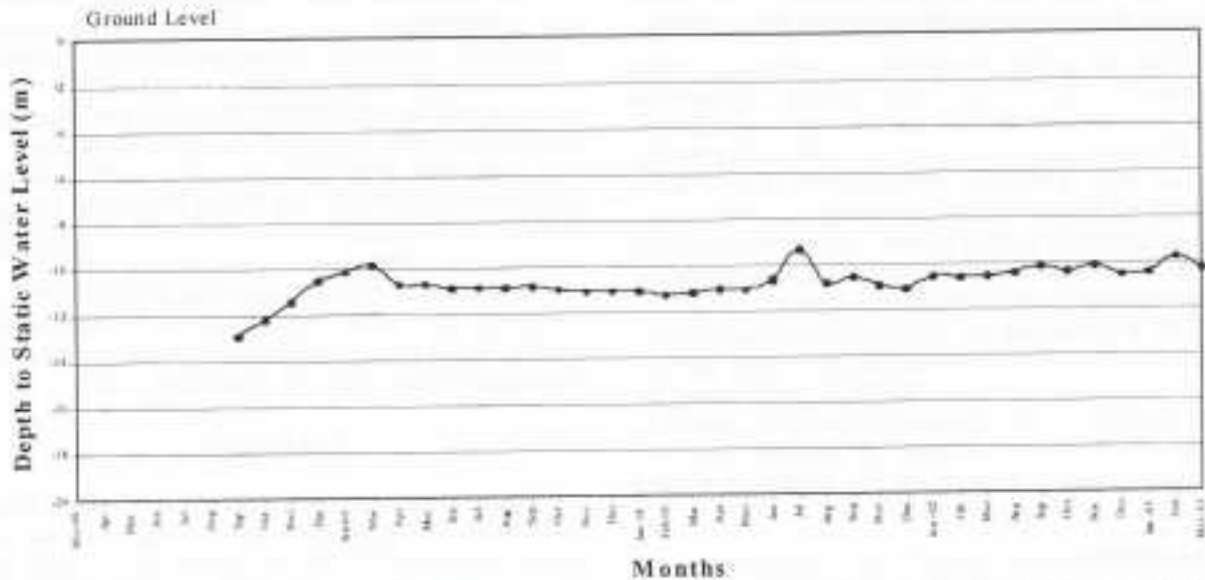


Fig. 2: Fluctuation of Water Level in Central Part of Kathmandu Valley (G-17, Patan Hospital) (Source: GWRDP).

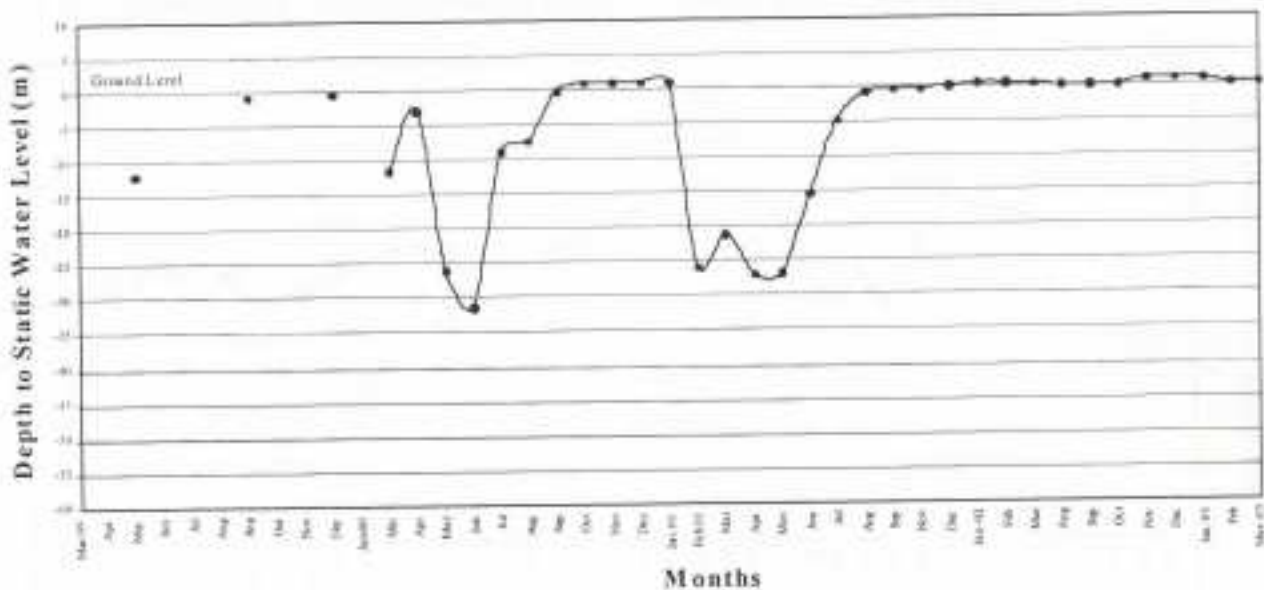


Fig. 3: Fluctuation of Water Level in Southern Part of Kathmandu Valley (PH-1, Pharping)



## भूमिगत जलश्रोत : एक परिचय

निर शाक्य

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### परिचय

करिब ७० प्रतिशत पृथ्वीको भाग पानीले ढाकेको छ । जसमध्ये समुद्र र महासागरका मुनिनी पानी अधिकांश पर्दछ भने करिब २.५ प्रतिशत पृथ्वीको भागमा हिमनदी वा हिउँ पस्नेर बल्ने समेतको शङ्क पानीमा ९० प्रतिशत भूमिगत अवस्थामा रहेको भूमिगत जल पर्दछ ।

आवश्यकता अनुसार उपलब्ध गर्न सकिने तथा गणस्तरयुक्त स्वच्छ जललाई प्रदूषण रहित तथा अन्धाधुन्ध तरिकाबाट अत्यधिक दोहन हुन नदिनु मानव मात्रको कर्तव्य हुन आउँछ ।

भूमिगत जलश्रोत के हो ?

पानीको विभिन्न श्रोतहरू मध्ये भूमिगत जलश्रोतलाई पनि एक श्रोत मान्न सकिन्छ । भूमिगत जल जमिन मुनि विशाल भण्डारको रूपमा रहेको हुन्छ । हामी देश नेपाल भू-परिवेष्ठित राज्य हो, तापनि धेरै ठाउँ रहेका समुद्र र महासागरका पानी सूर्यको तापक्रमको कारण तापिएर वाष्प बनि बादलको रूप लिन्छ । हावाको बहावको कारण बादल सँदै गर्दै पहाडमा ठप्कर खाई बग्छ हुन्छ । यही बर्षातको अधिकांश पानी जमिन माथि बगेर खोलाखालाको रूप धारण गर्दछ भने केहि भाग जमिनको ताप तथा बोट विस्फाको कारण वाष्पिकरण भएर वायुमण्डलमै फर्कन्छ । यसै गरी केहि अंश जमिन मुनि बालुवा, गिट्टिका छिद्रहरू मार्फत छिर्ने गर्छ भूमिगत जल बन्दछ । यो प्रकृया निरन्तर रूपमा चल्दै जाँदा कहीं पछि भूमिगत जल भण्डारको रूपमा परिणत हुन जान्छ । ईन्तार, पहाडी भेगमा देखा पर्ने स-साना जस्ता, कुवा, मूल आदि भूमिगत जलश्रोत नै हुन् । चिरा र दरार परेका कडा चट्टानहरूमा पनि पानी छिर्ने सक्ने हुदा भूमिगत जलको बहाव हुन सकिन्छ । कडा चट्टानहरू मध्ये भूमिगत जल विशेष रूपमा चुनडुंगामा बढी बहाव भएको पाइन्छ । बालाजुको बाईसधाराको पानी, फर्पिङ क्षेत्रको सतमुल, शेष नारायणको मूलको पानी कुनै कुनै टोल चौकमा रहेका हुने धाराको पानी पनि यसै चिरा र दरार परेका चट्टानमा जम्न गएका भूमिगत जल नै हुन् । भूकम्प तथा अन्य प्रकृयाबाट पृथ्वीमा ठूलो हलचल हुँदा चट्टानहरूको कमजोर भागमा चिरा तथा दरार पैदा हुने क्रममा घर्षणबाट एक किसिमको अप्रसरणशिल पदार्थ जम्मा हुन गर्छ भूमिगत जललाई सतहमा प्रदर्शित गर्दा मूल बनिन्छ । यस्ता क्षेत्रहरूमा होश नपुन्दाई ठुला ठुला संरचनाको निर्माण कार्य र सो क्षेत्रको वरिपरि जवाभावि रूपमा भूमिगत जललाई प्रयोगमा ल्याउँदा भने असर पर्न सक्छ । बालाजुको बाईसधारा केलावेला मा सुक्न जानु पनि यसको प्रमुख उदाहरण हुन् ।

जमिन मुनि विभिन्न किसिमका तहहरू हुन्छन् । यी तहहरू मध्ये कुनै बढी वा कम प्रसरणशिल हुन्छन् भने कुनै अप्रसरणशिल । प्रसरणशिल तहमा जाली (Screen) राखी पम्पको माध्यमबाट भूमिगत जललाई विभिन्न कार्यको लागि प्रयोगमा ल्याइन्छ । भूमिगत जल यी प्रसरणशिल भएको तह जस्तै गिट्टि तथा बालुवाको कारण खालि ठाउँबाट बहाव हुन्छ । जति जति कणहरू ठुला हुन्छन्, त्यति त्यति पानी रहने, बहाव हुने खालि

ठाउँ बढी हुन्छ । जस्तै बालुवाका कणहरू गिट्टिको तुलनामा साना भएको हुँदा पानी बहाव हुने खालि ठाउँ सानै हुन्छ । पानीको बहाव बढी हुन सक्ने तहलाई एक्स्किफर भनिन्छ । पानीको बहाव निश्चित स्थानमा सिमित भई रहँदैन, एक तहबाट अरु प्रसरणशिल क्षमता भएका तहहरूमा बहाव भई नै रहन्छ ।

स्यालो तथा डिप एक्स्किफर

स्यालो ट्युबवेल र डिप ट्युबवेलको एक्स्किफरमा फरक हुन्छ । स्यालो ट्युबवेलको एक्स्किफर कम गहिरोईको हुन्छ भने डिप ट्युबवेलको एक्स्किफर बढी गहिरोईको हुन्छ । ५० मिटर गहिरोई सम्मको ट्युबवेललाई स्यालो ट्युबवेल वा स्यालो एक्स्किफर मानिएको छ भने यस भन्दा बढी गहिरोईको ट्युबवेललाई डिप ट्युबवेल वा डिप एक्स्किफर मान्न सकिन्छ । स्यालो तथा डिप एक्स्किफरमा भूमिगत जलको परिपुर्ति वेलावेगै तरिकाबाट हुन्छ । स्यालो एक्स्किफर वा स्यालो ट्युबवेलमा मुख्य गरी बर्षातको पानी र नदी, नालाको पानी जमिनबाट नै प्रसरणशिल क्षमता भएको तहबाट सोभै छिर्ने गर्छ परिपुर्ति हुने गर्दछ । सानो बालुवामा प्रसरणशिल क्षमता धेरै कम हुने हुदा कमै मात्रामा पानी छिर्दछ भने खस्रो बालुवा र गिट्टि भएको तहमा प्रसरणशिल क्षमता बढी नै हुने हुँदा सो तहमा छिटै पानी छिरी खाली ठाउँ भन्ने गर्छ भूमिगत जलश्रोतको भण्डार बन्दछ । यसै डिप एक्स्किफरमा मुख्य परिपुर्ति हुने क्षेत्र चुरिया पहाडको फेदमा अवस्थित माथर क्षेत्र हुन् भने मुख्य श्रोत पनि बर्षात नै हो । माथर क्षेत्रमा ठूल-ठुला ढुङ्गाहरू भएको हुँदा प्रसरणशिल क्षमता बढी भएकोले बर्षातको पानी यस क्षेत्रको माध्यमबाट छिर्ने गर्छ परिपुर्ति हुन्छ । यसको जस्ता महाभारत थुल्लावाट बग्ने नदीहरू यस क्षेत्रमा आएपछि वेग कम भई पानी गुरुत्वाकर्षणको कारणबाट पनि छिर्ने गएर डिप एक्स्किफरमा परिपुर्ति हुन्छ । नेपालको तराई क्षेत्रमा बर्षात पनि धेरै हुने हुँदा बर्षातबाट मात्र अनुमानित परिपुर्ति ५८,००० लाख क्युबिक मिटर देखि ९६,००० लाख क्युबिक मिटर भएको आँकडा रहेको छ । जुन संख्याको हिसाबले तराईको सम्पूर्ण सिँचाई योग्य भूमि करिब १८ लाख हेक्टर भूमिगत जलबाट सिँचाई गर्न सकिन्छ । यस मध्ये करिब दुई लाख तिस हजार हेक्टरमा मात्र भूमिगत जलबाट सिँचाई भई रहेको छ ।

नेपालमा भूमिगत जलश्रोतको प्रयोग

नेपालमा भूमिगत जल निम्न प्रयोजनको लागि प्रयोगमा ल्याइरहेको पाइन्छ ।

- \* खानेपानी
- \* उद्योगधन्दा
- \* सिँचाई

तराईका अधिकांश नगर क्षेत्रहरूमा खानेपानी आपूर्तिको लागि खानेपानी संस्थानले भूमिगत जल नै बढी प्रयोगमा ल्याइरहेको छ । भूमिगत जल प्रयोग गर्ने पम्प पनि मुख्यायामा पानीको लेभल घट्न गएमा पनि असर

नपने गरी डिजाईन गर्ने हुँदा उक्त समयमा पनि भूमिगत जल प्रयोग गरी नै रहन सकिन्छ । तराई क्षेत्रमा हाल करिब १ लाख ८५ हजार लिटर भूमिगत जल खानेपानीको लागि प्रयोगमा ल्याइएको छ । तराई बाहेक काठमाण्डौ उपत्यकामा पनि खानेपानीको लागि भूमिगत जल नै अत्यधिक प्रयोगमा ल्याइएको पाइन्छ । यस क्षेत्रमा दैनिक १५ करोड लिटर पानीको माग हुने गरेकोमा खानेपानी संस्थानले वर्षायाममा १२ करोड लिटर र हिउँदमा ९ करोड ५० लाख लिटर खानेपानी आपूर्ति गर्दै आएको छ । आपूर्ति गरिरहेको मध्ये करिब ५० प्रतिशत पानी भूमिगत पानी नै हो । जापानी सरकारको एक सर्वेक्षण अनुसार काठमाण्डौ उपत्यकामा मात्र १ करोड ५० लाख लिटर भूमिगत पानी दैनिक प्रयोग गर्ने सकिन्छ । तर करिब ५ करोड लिटर पानी प्रति दिन प्रयोग भै रहेको पाइन्छ । यसरी भूमिगत जल भण्डारको हिस्सा बराबरी अत्यधिक दोहन भइरहेको देखिन्छ । अंकड़ा अनुसार १४० लाख क्यूबिक मिटर प्रति वर्ष काठमाण्डौ उपत्यकामा भूमिगत जल खानेपानीको लागि प्रयोग भैरहेको पाइन्छ ।

विशेष गरी काठमाण्डौ उपत्यकामा उद्योग धन्दा संचालनको लागि पनि विभिन्न कलकारखाना, प्राइमेट होटेल, गलैचा कारखानाहरुमा खानेपानी संस्थानबाट पानी आपूर्ति गर्ने तसकेको कारण गिनीहरुले अन्धाधुन्ध तवरले भूमिगत पानीको लागि प्राइमेट कम्पनीहरु मार्फत डिप टयुबवेल निर्माण गरी भूमिगत पानीको अत्यधिक दोहन गरेको पाइन्छ । अंकड़ा अनुसार करिब चालिस लाख क्यूबिक मिटर प्रति वर्ष उद्योग धन्दाको प्रयोजनमा काठमाण्डौ उपत्यकामा भूमिगत जल प्रयोग भइ रहेको देखिन्छ ।

सिंचाईको लागि भूमिगत जल तराई क्षेत्रमा मात्र स्वासो तथा डिप टयुबवेलको माध्यमबाट प्रयोगमा ल्याइएको छ । प्रयोगको तुलनामा परिपूर्ति अत्यधिक भइरहेको कारण तराई क्षेत्रमा हाल कुनै हानीकारक अवस्थामा देखिँदैन । यस क्षेत्रमा सिंचाईको लागि वर्षेनि ५५०० लाख लिटर प्रयोग भएको पाइन्छ ।

एक अर्को सर्वेक्षण अनुसार काठमाण्डौ उपत्यकामा हाल १३० लाख क्यूबिक मिटर भूमिगत पानी बढी प्रयोग भैरहेको देखिन्छ भने तराई क्षेत्रमा परिपूर्तिको (Recharge) तुलनामा धेरै नै पानी कम प्रयोग भैरहेको पाइन्छ । अतः काठमाण्डौमा भूमिगत जल अत्यधिक दोहन भइरहेको अंकड़ा बमोजिम पानी निकाल्दै जाँदा कुनै दिन भण्डार रितिन गर्दै प्रकृति प्रकोप हुने संभावना हन आउँछ । यसर्थ परिपूर्ति हुने क्षेत्रको संरक्षण गरी अन्धाधुन्ध तरिकाबाट ठूला ठूला निर्माण कार्यमा रोकको साथै भूमिगत जलको आवश्यक व्यवस्थापन गर्नु अत्यन्त जरुरि देखिन्छ । साथै भूमिगत जल शास्त्रको विभिन्न पक्षको अध्ययन पश्चात् मात्र भूमिगत जल प्रयोग गर्न दिनु पर्दछ । यस कार्यको लागि भूमिगत जल कानूनको आवश्यकता देखिन्छ । यति तथ्यलाई मननु गरी श्री ५ को सरकारबाट भूमिगत जल कानून लागु गरी जलश्रोत मन्त्रालय अन्तर्गत भूमिगत जलश्रोत विकास समितिबाट व्यवस्थापन गराउनुपर्ने देखिन्छ । साथै ढुङ्गे धाराको मुहानको रूपमा उतिबेला बनाईएको रानीपोखरी जस्ता Infiltration Ponds पर्यटकको रूपमा मात्र होइन, वैज्ञानिक तवरबाट पनि संरक्षण हुनु अत्यावश्यक छ ।

हामै तराई क्षेत्रको स्थानीय टयुबवेलको पानीमा आर्सेनिक पाईएको भनी बेलाबेलामा पत्र पत्रका माफत प्रचारमा आईरहेको पाइन्छ, यस कुराको पुष्टि पनि सम्बन्धित निकायबाट हुनुपर्नेमा विभिन्न गैर सरकारी संस्थाहरुबाट प्रचार भइरहेको छ । भूमिगत जलमा आर्सेनिक होस् वा अन्य कुनै गुणस्तर सम्बन्धीको कुरा होस् वा खानेपानी वा अन्य उद्योग धन्दा संचालनको लागि गर्ने भूमिगत जल प्रयोजनको लागि ड्रिलिङ कार्य होस् श्री ५ को सरकारको आधिकारिक निकायबाट पुष्टि हुनु पर्ने कुरालाई पनि कानून भित्र समावेश गर्नु पर्ने कुरा नकान्न सकिँदैन ।



## नेपालमा भूमिगत जल सिंचाई कार्यक्रम: एक झलक

निर. शास्त्र

भूमिगत जलस्रोत विकास परियोजना, बजरमहल, काठमाडौं, नेपाल

नेपालमा सर्वप्रथम भूमिगत जलस्रोतको सर्वेक्षण कार्य सन् २०२४ सालमा जलस्रोत सर्वेक्षण विभाग अन्तर्गत जमीनमुनिको पानी सर्वेक्षण इकाईको रूपमा स्थापना भयो। २०२६ सालमा यो इकाईको नामाकरण भूमिगत जल सर्वेक्षण विकास समिति भई पछिल्लो पटक अमेरिकी सहयोगबाट पश्चिमी तराईको सात वटा जिल्लाहरू नवलपरासी, रुपन्देही, कपिलवस्तु, बाँके, बर्दिया, कैलाली तथा कञ्चनपुरमा अन्वेषण कार्य भएको थियो। तत्पश्चात् २०३१ सालमा भूमिगत जलस्रोत विकास समितिको नामाकरण भई तराईका विभिन्न तीन वटा जिल्लाहरू तथा भित्री मधेशको दुई जिल्लाहरू दाङ र चितवन समेतमा भूमिगत जलको अन्वेषण, अध्ययन र भूमिगत जलको परिमाण र गुणस्तर पहिचान गर्ने काम शुरु भयो। यस समिति अन्तर्गत भूमिगत जलस्रोत विकास परियोजना स्थापना भई सो अन्तर्गत आठवटा फिल्ड कार्यालयहरू मार्फत हालसम्म सो सम्बन्धी कार्य हुँदै आएको छ।

अध्ययन तथा अनुसन्धानको आधारमा प्राप्त तथ्यांक अनुसार तराई क्षेत्रमा ३२६,००० हेक्टर जमिनमा स्थानीय ट्युबवेलको र १,९०,००० हेक्टर जमिनमा ड्रिप ट्युबवेलको राम्रो सम्भाव्यता पाईएको छ। तराई क्षेत्रको वार्षिक भूमिगत जलको हिस्साफलता यसरी रहेको छ।

- \* वर्षेनी भूमिगत जल परिपूर्ण हुने : ८८,००,००० लिटर
- \* वर्षेनी सिंचाईको लागि प्रयोग हुने : ४,४०,००० लिटर
- \* वर्षेनी छानेपानीको लागि प्रयोग हुने : १,८४,००० लिटर
- \* वर्षेनी बाँकी भण्डारमा रहिरहने : ८०,६४,००० लिटर

आठौँ योजनाको अन्त सम्ममा भूमिगत जलको उपयोग गरी विभिन्न निकाय अन्तर्गत संचालित भूमिगत जल सिंचाई आयोजनाहरूबाट १,६९,३२१ हेक्टर जमिनमा सिंचाई पुऱ्याईएको छ भने नवौँ पंचवर्षीय योजनामा सिंचाई विभाग अन्तर्गत भूमिगत जलबाट ४४ ३०,४०० हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराउने लक्ष्य अनुरूप आ.व. ०४.८।०४.९ सम्म जम्मा २४,२२२ हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराईएको छ। यसरी विभिन्न निकाय समेत हालसम्म कुल २,३०,००० हेक्टर क्षेत्रफल भूमिमा सिंचाई सुविधा प्राप्त भएको छ।

अध्ययन तथा अन्वेषण कार्यबाट संभाव्य देखिएका क्षेत्रहरूमा भूमिगत जल सिंचाई कार्यक्रम तथा आयोजनाहरू लागू गरी सम्पन्न तथा संचालनमा रहेका कार्यक्रमहरू निम्न बमोजिम छन्।

### सम्पन्न सिंचाई कार्यक्रम

क) इरिगेसन लाईन अफ क्रेडिट (आई.एल.सि.) कार्यक्रम :

विश्व बैंकको अञ्च सहयोगमा आई.एल.सि. कार्यक्रम पश्चिमी तराईको ७ वटा जिल्लाहरू कैलाली, कञ्चनपुर, बर्दिया, बाँके, दाङ, कपिलवस्तु तथा नवलपरासीमा आ.व. २०४४।०४।६ देखि आ.व. २०४९।०४।४ सम्म संचालित योजना हो। यस योजनाबाट स्थानीय तथा ड्रिप ट्युबवेलको माध्यमबाट कुल ४९,८४ हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराईएको छ।

समूहक्षेत्र (Cluster) बनाई कृषक समूहको मागको आधारमा संचालित यो योजनामा स्थानीय ट्युबवेल सिंचाईको लागि १४ प्रतिशत र ड्रिप ट्युबवेल सिंचाईको हकमा १० प्रतिशत कृषक समूहबाट व्यहोरी स्वयं कृषकहरूबाट नै सिंचाई प्रणाली संचालन भइरहेको छ।

ख) सामुहिक स्थानीय ट्युबवेल सिंचाई कार्यक्रम :

अन्तराष्ट्रिय कृषि विकास कोष (IFAD) को अञ्च सहयोगमा तराईका सुर्खडा तथा बाँकी प्रभावित ४ वटा रौतहट, सर्लाही, सिरहा, सप्तरी र सुनसरी जिल्लाहरूमा स्थानीय ट्युबवेलको माध्यमबाट सिंचाई सुविधा पुऱ्याउन यो कार्यक्रम आ.व. ०४.१।०४.२ मा लागू भई आ.व. २०४५।०४.८ मा सम्पन्न भयो। यस आयोजना अन्तर्गत निर्माण भएका सबै स्थानीय ट्युबवेलहरू कृषक समूहको मागको आधारमा भएकोले कृषकहरूलाई नै हस्तान्तरण गरी कुल ४,८४४ हेक्टर जग्गामा सिंचाई सुविधा उपलब्ध भइरहेको छ।

ग) बैरहवा-सुम्बिनी भूमिगत जल परियोजना

विश्व बैंकको अञ्च सहयोगमा रुपन्देही जिल्लामा संचालित यस परियोजना आ.व. ०३.३।०३.४ देखि शुरु भई आ.व. ०४.४।०४.६ मा सम्पन्न योजना हो। प्रथम, द्वितीय र तृतीय चरण गरी कुल १६९ ट्युबवेल संरचना कृषक सहभागितामा निर्माण भई कुल २०,३०९ हेक्टर जमिनमा सिंचाई सुविधा यस आयोजना अन्तर्गत भइरहेको छ।

हाल यस परियोजनामा Project Operation Plan (POP) अन्तर्गत कृषि विस्तार कार्यक्रम संचालन भइरहेको छ।

(३) यसैगरी एशियाई विकास बैंक तथा अन्तराष्ट्रिय कृषि विकास कोषको सहयोगमा सिराहा, सप्तरी तथा उदयपुर जिल्लामा २,६७९ स्थानीय तथा २९ ड्रिप ट्युबवेलहरू निर्माण गरी सगरमाथा एकीकृत ग्रामिण विकास परियोजना अन्तर्गत १३,९४० हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराई सकेको छ भने श्री ५ को सरकारकै लगानीमा समेत महोत्तरी, कैलाली, कञ्चनपुर तथा कपिलवस्तु नलक्ष्मण आयोजनाहरूबाट क्रमशः १००० हेक्टर, ६०० हेक्टर तथा २०० हेक्टर भूमिमा सिंचाई सुविधा उपलब्ध गराई सकेको छ।

### संचालनमा रहेका कार्यक्रमहरू

(क) भूमिगत जल अन्वेषण

श्री ५ को सरकारको धोतबाट निम्न कार्यहरू सञ्चालनमा रही सम्पन्न भइरहेको छ।

- \* भूमिगत जल अन्वेषण गरी भूमिगत जलको परिमाण र गुणस्तर मूल्याङ्कन गर्ने।
- \* भूमिगत जल सम्बन्धी डाटा बेश स्थापना गर्ने।
- \* प्राप्त तथ्यांकहरूको विश्लेषणबाट संभाव्य योजनाहरू छनौट गर्ने।

उपरोक्त कार्यहरूको अलावा यस कार्यक्रम अन्तर्गत विवैयक र नैसर्गिक संरक्षणको अनुदानमा आर्सेनिक अध्ययन कार्य हुदैछ भने मेलासुखी खानेपानी समितिको आर्थिक श्रोतबाट काठमाण्डौ उपत्यकाको भूमिगत जल अध्ययन र अनुगमन कार्य भैरहेको छ। साथै यस कार्यक्रम अन्तर्गत क्षेत्रगत तवरमा हाइड्रोजियोलोजिकल नक्सा समेत तयार गर्ने योजना रहेकोमा यस आ.व. २०१९/२०२० मा मध्यमाञ्चल क्षेत्रको नक्सा तयार गर्ने कार्य भइरहेको छ।

#### ख) नेपाल सिंचाई सेक्टर कार्यक्रम

विषय बैंकको ऋण सहयोगमा पश्चिमी तराईका ८ वटा जिल्लाहरू (कैलाली, कंचनपुर, बर्दिया, बाँके, दाङ, कपिलवस्तु, नवलपरासी, रुपन्देही) मा आ.व. २०१४/२०१५ देखि संचालित यस कार्यक्रमबाट पाँच वर्षको कार्य अवधिमा नयाँ भूमिगत जलसिंचाई प्रणालीबाट ७,५०० हेक्टर, डिप तथा स्यालो ट्युबवेल सिंचाई ५,०० हेक्टर र अन्येषणको प्रयोजनबाट निर्माण भएका डिप ट्युबवेलमा आवश्यक संरचना निर्माण गरी टन क्षेत्रबाट ५०० हेक्टर गरी जम्मा ८,५०० हेक्टर जमिनमा सिंचाई सुविधा पुर्‍याउने लक्ष्य लिएकोमा हाल सम्म कूल ५,३२७ हेक्टर जमिनमा सिंचाई सुविधा कृषक समूहको सहभागितामा उपलब्ध गराई सकेको छ। यस आ.व. २०१९/२०२० मा अधुरो कार्य बाँकी संरचना निर्माण गरी १,२२५ हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराउन एक वर्ष थप भएको छ। आवश्यक संरचना बमोजिम डिप र स्यालो ट्युबवेल सिंचाई प्रणाली निर्माण गरी डिप ट्युबवेलबाट ४० हेक्टर तथा स्यालो ट्युबवेलबाट १० हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध हुनेछ र प्रति हेक्टर मूल्य क्रमशः डिप ट्युबवेलमा रु. ७५,००० तथा स्यालो ट्युबवेलमा रु. २३,५०० लाग्ने छ।

#### ग) सामुदायिक भूमिगत जल सिंचाई सेक्टर आयोजना (CGISP)

एशियाई विकास बैंकको ऋण सहयोगमा भूपा देवि चितवन सम्म तराईका बाइवटा जिल्लाहरूमा १५,००० स्यालो ट्युबवेल निर्माण गरी करिब ६०,००० हेक्टर जग्गामा सिंचाई सुविधा पुर्‍याउने लक्ष्य लिए आ.व. ०५४/०५५ देखि शुरु भएको यस आयोजना अन्तर्गत भूपा, मोरङ, बारा, पर्सा र रौतहट जिल्लाहरूमा आ.व. ०५८/०५९ सम्म ३८६ वटा स्यालो ट्युबवेलहरूबाट जम्मा १,६९३ हेक्टर भूमिमा सिंचाई सुविधा उपलब्ध गराई सकेको छ भने आ.व. ०५९/०६० मा २,००० वटा स्यालो ट्युबवेल निर्माण गरी ७,००० हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराउने कार्य भैरहेको छ।

यस आयोजना अन्तर्गत कूल १५,००० गोटा स्यालो ट्युबवेल निर्माण गर्नु पर्नेमा ९३,५०० गोटा कृषक समूहगत रूपमा र १५,०० गोटा व्यक्तिगत रूपमा निर्माण हुने छ। लागू भएका बाइ वटा जिल्लाहरू मध्ये छनौट भएका प्रत्येक गा.वि.स.लाई एक सब (प्रोजेक्ट मानिएको छ भने समूहगत स्यालो ट्युबवेललाई समूह नै धितो हुने छ। व्यक्तिगत ट्युबवेलको हकमा नगद वा लालपुजा धितो राख्नुपर्ने प्रावधान यस आयोजनामा रहेको छ। साथै प्रत्येक गा.वि.स.मा ४० गोटा स्यालो ट्युबवेल निर्माण भएमा २.८ कि.मि. ग्रामीण कृषि सडक समेत कार्य समेत गर्ने प्रावधान यस आयोजना अन्तर्गत छ। तर स्यालो ट्युबवेलमा दिई आएको अनुदान श्री ५ को सरकारको निर्णय बमोजिम शून्य अनुदानमा रहेको छ भने तालिम तथा प्राविधिक सहयोग आयोजनाबाट चरणबद्ध रूपमा भई नै रहने छ।

#### ३) भूमिगत जल सिंचाई, दीर्घकालीन कृषि योजना (ए.पि.पि.) स्थानी र डिप विशेष कार्यक्रम :

दीर्घकालीन कृषि योजनाले निर्दिष्ट गरेको लक्ष्य अनुरूप तराई क्षेत्रमा (तराईका २० वटा जिल्ला) भूमिगत जल सिंचाई तर्फ प्रति वर्ष स्यालो ट्युबवेलको माध्यमबाट २२,००० हेक्टर र डिप ट्युबवेलको माध्यमबाट २,००० हेक्टर गरी कूल २४,००० हेक्टर जमिनमा सिंचाई सुविधा थप गदै जानुपर्ने प्रावधान रहेको छ। उक्त लक्ष्य अनुरूप स्यालो ट्युबवेल तर्फ ८,८०० वटा (२.५ हेक्टर सिंचित क्षेत्रफलको दरले) र ४० हेक्टर सिंचित क्षेत्रफलको दरले डिप ट्युबवेल ५० गोटा निर्माण गर्नु पर्ने हुन्छ।

ए.हि.वि. र ए.पि.एल. श्रोतबाट आ.व. ०५४/०५६ देखि व्यक्तिगत र समूहगत स्यालो ट्युबवेलमा क्रमशः ३० र ६० प्रतिशत अनुदानबाट शुरु भएको यस कार्यक्रममा हाल स्यालो ट्युबवेल तर्फ शून्य अनुदान रहेको छ भने डिप ट्युबवेल तर्फ सम्पूर्ण संरचना सहित सिंचाई नीति बमोजिम ८५ प्रतिशत अनुदान रहेको छ। यसै गरी स्यालो ५ ट्युबवेल कार्यक्रम तर्फ एक गा.वि.स. क्षेत्रमा २० गोटा ट्युबवेल कृषकबाट निर्माण गरेमा रु. २५०,००० को छापीण सडक समेत तथा सुधार कार्य गर्ने रणनीति आयोजनाले लिएको छ। तालिम तथा प्राविधिक सरसल्लाह अरु कार्यक्रममा जस्तै यस कार्यक्रममा पनि चरण बद्ध रूपमा हुनेछ।

आ.व. ०५४/०५९ सम्ममा स्यालो ट्युबवेलबाट ९,०४५ हेक्टर र डिप ट्युबवेलबाट ६८० हेक्टर गरी कूल ९,७२५ हेक्टर क्षेत्रफलमा सिंचाई सुविधा उपलब्ध भैसकेको छ। आ.व. ०५९/२०६० मा डिप ट्युबवेल कार्यक्रम तर्फ १४ वटामा बाँकी अधुरो कार्य पूरा र नयाँ ३ वटा डिप ट्युबवेल संरचना निर्माण गरी करिब ६०० हेक्टरमा सिंचाई पुर्‍याउने लक्ष्य राखिएको छ।

वैदेशिक श्रोतबाट पुरै बजेट प्राप्त नहुदा हाल सम्मको प्रगति निर्दिष्ट लक्ष्य अनुसार नभएको दृष्टि देखिन्छ।

#### ङ) सिंचाई विकास कार्यक्रम :

युरोपियन युनियन (EU) को अनुदान सहयोगमा बाँके जिल्लामा १७ गोटा डिप ट्युबवेल निर्माण गरी कूल ६८० हेक्टर क्षेत्रफलमा सिंचाई सुविधा उपलब्ध गराउने लक्ष्य राखिएकोमा आ.व. ०५८/०५९ सम्ममा जम्मा २४० हेक्टर जमिनमा सिंचाई सुविधा उपलब्ध गराईसकेको छ। आ.व. ०५९/२०६० मा बाँकी संरचनाहरूको निर्माण कार्य पूरा गरी सम्पूर्ण ६८० हेक्टर जमिनमा सिंचाई पुर्‍याउने लक्ष्य यस कार्यक्रमले लिएको छ।

डिप ट्युबवेल संरचनाको हकमा एन.आई.एस.पि. तथा ए.पि.पि., विशेष कार्यक्रमको डिप ट्युबवेल संरचना बमोजिम नै हुनेछन्।

उल्लेखित संचालनमा रहेका आयोजना र कार्यक्रमको अलावा निम्न कार्यक्रमहरू उल्लेख भएका जिल्लाहरूमा कार्यान्वयनको लागि कारवाही भैरहेको छ।

\* भारतिय सहयोगको रिलिफ प्याकेज कार्यक्रम अन्तर्गत डिप ट्युबवेल सिंचाई प्रणाली (८८० हेक्टर): सुनसरी, सप्तरी र सिराहा जिल्लाहरू।

\* जापानी सहयोगको डिप ट्युबवेल सिंचाई प्रणाली (३२,००० हेक्टर): भूपा, महोत्तरी र बाँके, बर्दिया।

\* नेपाल ईरिगेशन सेक्टर कार्यक्रम (दोश्रो) अन्तर्गत स्यालो डिप ट्युबवेल सिंचाई प्रणाली। १४,२५० हेक्टर: नवलपरासी, रुपन्देही, कपिलवस्तु, दाङ, बाँके, बर्दिया, कैलाली र कञ्चनपुर।



## नेपालमा प्रकोप व्यवस्थापन

### लेखनाथ पोखरेल

सा. औ. नि. तथा दैवी प्रकोप व्यवस्थापन विभाग, गृह मन्त्रालय, सिंहदरवार, काठमाडौं, नेपाल

नेपालमा भू-वनीतको कारण समय समयमा आइपर्ने प्राकृतिक विपत्तिहरू, भू-कम्प, बाढी, पहिरो जस्ता प्राकृतिक प्रकोप एकातिर क्षण परेको छ भने अर्को तर्फ मानवजन्य विपत्तिहरू आगलागी तथा रोगव्याधि जस्ता महामारीबाट समेत बर्सेनी ठूलो धन जनको क्षति बेहोर्नु परेको छ । नेपालमा बर्षेन सरदर एक हजार मानिसहरूको मृत्यु प्राकृतिक प्रकोपबाट हुने गरेको पाइन्छ । बाढी पहिरोबाट मात्र बर्षेनी सरदर ५०० मानिसहरूको मृत्यु भएको पाइन्छ ।

२०३९ साल भन्दा पहिले मुलुकमा प्रकोप व्यवस्थापनको कुनै व्यवस्थित परिपाटी थिएन । प्राकृतिक प्रकोपबाट प्रभावित हुन गएका सर्वसाधारण जनताहरूको जिउ, धन तथा सार्वजनिक सम्पत्तिको सुरक्षा गर्ने तथा प्रकोप सम्बन्धी उद्धार कार्यहरू गर्न गराउनको लागि हाम्रो मुलुकमा छुट्टै कार्यालय वा सो सम्बन्धी ऐन कानूनहरूको व्यवस्था भएको थिएन । हाम्रो मुलुकमा एकातिर आधारभूत विकास कार्यकालागि स्रोत साधनको अभाव छ भने अर्को तिर कष्ट साध्य डुइले खडा गरिएका संरचनाहरू पनि प्रकोपका कारण नोक्सान भइरहेको विडम्बनापूर्ण स्थिति छैदछ ।

**दैवी प्रकोप उद्धार ऐन, २०३९ सम्बन्धी व्यवस्था:** २०३९ साल भन्दा पहिले प्रकोप पीडितहरूलाई उद्धार गर्ने र सहुलियत पुऱ्याउने कार्य सामाजिक कार्यका रूपमा र पहुँचका आधारमा हुने गर्दथ्यो । प्रकोपमा परेका जनताको जिउ, धन को सुरक्षा गर्ने, पीडितहरूको उद्धार कार्य गर्न र सर्वसाधारण जनतालाई सुविधा प्रदान गर्ने उद्देश्यले २०३९ सालमा पहिलो पटक दैवीप्रकोप (उद्धार) ऐन २०३९ जन समझ ल्याइएको छ । कानूनी रूपमा यो ऐन कोशेढुंगा (Mile-stone) को रूपमा पनि सावित भएको छ । उक्त ऐनमा समसामयिक सुधार गर्ने उद्देश्यले वि.सं. २०४३, २०४५ र २०४९ सालमा तीन पटक संशोधन गरिएको छ । यी प्राकृतिक तथा मानव सृजित विपत्तिहरूको संभावित क्षतराबाट जनतालाई बचाउने सो धरेको ज्ञान दिनुको, विपत्ति परेका वखत राहत उद्धार कार्य व्यवस्थित ढंगबाट सञ्चालन गर्न गराउन तथा यस्ता विपत्तिबाट प्रभावित जनताको उपयुक्त ढंगबाट पुनःस्थापना तथा प्राकृतिक प्रकोपबाट नोक्सान भएका सम्पदा, भौतिक संरचना जस्ता कुराको पुनःनिर्माण गर्न गराउने जस्ता कार्यलाई मुलुकभर व्यवस्थित ढंगबाट परिचालन गर्ने कुराको ठूलो महत्व रहेकै प्रसंगमा दैवी प्रकोप (उद्धार) ऐन, २०३९ को व्यवस्था भएको र सो को कार्यान्वयन गर्न समेत सशक्त संगठनको खाँचो महसूस गरी गृह मन्त्रालय अन्तर्गत लागु औषध नियन्त्रण तथा दैवी प्रकोप व्यवस्थापन विभागको गठन भएको छ ।

भूकम्प, बाढी, पहिरो, ओषिबेहरी, अतिवृष्टि, अनावृष्टि, आगलागी, अनिक्कल, महामारी, औद्योगिक दुर्घटना, विस्फोटक वा विषाक्त पदार्थद्वारा हुने दुर्घटना तथा यस्तै अन्य कुनै प्रकारको प्राकृतिक प्रकोपलाई दैवी प्रकोप (उद्धार) ऐन, २०३९ ले दैवी प्रकोप हुन् भनि स्पष्ट परिभाषा गरेको छ । यस परिभाषाको मनसाय अप्रत्याशित रूपमा घटना घट्ने र मानवीय क्षमता भन्दा बाहिरका प्राकृतिक वा मानव सृजित अवस्थाका घटनाहरूलाई दैवी प्रकोप को दायरा भित्र पार्न खोजिएको देखिन्छ ।

**विभिन्न समितिहरू सम्बन्धी कानूनी प्रावधान :** दैवी प्रकोप (उद्धार) ऐनमा दैवी प्रकोप उद्धार कार्य सम्बन्धी नीतिको तर्जुमा गर्ने, दैवी प्रकोप सम्बन्धी विविध कार्यक्रम बनाउन र कार्यान्वयन गर्न तथा तत् सम्बन्धी अन्य आवश्यक काम कारवाही गर्न गराउनको लागि केन्द्रीय स्तरमा माननीय गृहमन्त्रीको अध्यक्षतामा प्रकोप व्यवस्थापन संघ सम्बन्धित उच्च पदस्थ पदाधिकारीहरू समेत रहने गरी केन्द्रीय दैवी प्रकोप उद्धार समितिको व्यवस्था गरिएको छ । प्रकोपबाट असर परेको इलाकालाई संकटग्रस्त क्षेत्रको घोषणा गर्न श्री ५ को सरकारलाई सिफारिस गर्ने, दैवी प्रकोपको निषेधन रोकथाम, तत्सम्बन्धी पूर्ण तयारी र दैवी प्रकोपबाट पीडित जनताको पुनःस्थापन तथा प्रभावित क्षेत्रको पुनःनिर्माण सम्बन्धी राष्ट्रिय नीति को तर्जुमा गर्ने, दैवी प्रकोप प्रभावित क्षेत्रमा वितरण गरिने सहायता रकम तथा आवश्यक हुने सत्ता कषडा र अन्य सामग्रीहरू संकटग्रस्त क्षेत्रमा पठाउने, सामाजिक संघ संस्थाहरूलाई उद्धार कार्यमा समन्वय गराउने, जिल्ला समिति तथा स्थानीय समितिलाई उद्धार कार्य गर्न गराउन निर्देशन दिने जस्ता महत्वपूर्ण कार्यहरू यस समितिको कार्य क्षेत्र भित्र पर्दछन् ।

यसैगरी केन्द्रीय समितिलाई आवश्यक मुकाव र सल्लाह दिन, केन्द्रीय समितिले दिएका नीति निर्देशनहरू कार्यान्वयन गर्न सघाउ पुऱ्याउन तथा दैवी प्रकोप परेको बेला उद्धार र पुनःस्थापनको कार्य प्रभावकारी ढङ्गले सञ्चालन गर्न गराउन उद्धार तथा उपचार उप-समिति र आपूर्ति, आश्रय तथा पुनःस्थापन उप-समिति समेत गठन गर्ने सकिने व्यवस्था गरिएको छ । यस्तै प्रकोपको समयमा क्षेत्रीय तथा स्थानीय स्तरमा उद्धार तथा पुनःस्थापनाको लागि चाहिने आवश्यक स्रोत तथा साधन को मूल्याङ्कन गर्ने, आवश्यकता अनुसार स्वयं सेवक टोली गठन गर्न तथा अन्य उद्धार कार्य समेत गर्न गराउनका लागि क्षेत्रीय दैवी प्रकोप उद्धार समिति क्षेत्रिय प्रशासकको अध्यक्षतामा गठन भएको छ । सो अनुरूप श्री ५ को सरकार ले ५ विकास क्षेत्रमा १-१ क्षेत्रीय प्रशासन कार्यालयको स्थापना गरी समन्वयात्मक ढङ्गले कार्य सञ्चालन प्रारम्भ गराएको छ । यसैगरी स्थानीय दैवी प्रकोप उद्धार समिति गठन हुने कानूनी प्रावधान पनि रहेको छ । प्रकोपबाट प्रभावित जिल्लामा पीडित व्यक्तिहरूलाई तत्काल उद्धार गर्ने र तत् उपरबन्ध गराउन प्रकोपको घटना रोकथाम गर्न तथा अस्थायी आश्रयको समेत व्यवस्था गर्न गराउनको लागि प्रमुख जिल्ला अधिकारीको अध्यक्षतामा जिल्ला स्थित प्रकोप व्यवस्थापन संघ सम्बन्धित निकायका प्रमुखहरू समेत रहने गरी जिल्ला दैवी प्रकोप उद्धार समितिको गठन हुने व्यवस्था छ ।

**केन्द्रीय दैवी प्रकोप उद्धार समितिले तय गरेको मापदण्ड :** विभिन्न प्रकारका दैवी प्रकोपका घटनाबाट पीडित परिवार एवं व्यक्तिहरू लाई तत्काल राहत सहयोग उपलब्ध गराउन केन्द्रीय दैवी प्रकोप उद्धार समितिले देशभरको मापदण्डको निर्धारण गरेको छ । सो अनुसार प्रकोप पीडित व्यक्ति एवं परिवारलाई राहत उपलब्ध गराउने व्यवस्था रहेको छ । दैवी प्रकोपका घटनामा परी कुनै व्यक्तिको मृत्यु भएको रहेछ भने राहत

स्वरूप प्रति मृतक रु. १०,०००/- (दश हजार) का दरले मृतकका परिवारलाई सहयोग उपलब्ध गराउने, दैवी प्रकोपको घटनामा परी घाइते भएकाहरूलाई जिल्ला दैवी प्रकोप उद्धार समितिले औषधोपचारको व्यवस्था गर्ने व्यवस्था रहेको छ। निर्धारित मापदण्ड बमोजिम राहत सहयोग उपलब्ध गराउदा जिल्ला दैवी प्रकोप उद्धार समितिले घटना भएको ३० दिन भित्र सूचना प्राप्त भएको घटनाका लागि मात्र राहत सहयोग उपलब्ध गराउने व्यवस्था छ।

**आर्थिक स्रोत सम्बन्धी व्यवस्था** : केन्द्रीय दैवी प्रकोप उद्धार समिति अन्तर्गत संचालन हुने गरी एउटा केन्द्रीय दैवी प्रकोप सहायता कोष खडा गरिएको छ। यसैगरी क्षेत्रीय दैवी प्रकोप सहायता कोष खडा भएका छन्। केन्द्रीय सहायता कोषमा धी ५ को सरकार अर्थ मन्त्रालयबाट विनियोजन भएको रकम र दैवी प्रकोप सम्बन्धमा प्राप्त हुने वैदेशिक सहयोगको विविध रकम जम्मा हुने गर्दछ। यसका अतिरिक्त समय समयमा प्रधान मंत्री दैवी प्रकोप सहायता कोषबाट पनि रकम प्राप्त हुने गर्दछ। केन्द्रीय दैवी प्रकोप सहायता कोषबाट आवश्यकता र औचित्यताका आधारमा निर्धारित मापदण्ड अनुसार प्रकोप पीडितलाई राहत सहयोग उपलब्ध गराउन आवश्यक पर्ने रकम जिल्ला दैवी प्रकोप सहायता कोषमा निकास्या दिने गरिन्छ।

**दशौ योजनामा प्रकोप व्यवस्थापनको उद्देश्य र रणनीतिहरू** : प्रकोप व्यवस्थापनको कार्यालाई व्यवस्थित एवं प्रभावकारी बनाई देशमा संचालित विकास निर्माणका कार्यक्रमहरूलाई दिगो, भरपर्दो, एवं उच्च प्रतिफल युक्त बनाउनको साथै जन जीवनलाई प्रकोपबाट सुरक्षित राख्न ठोस योगदान पुऱ्याउन दशौ योजनामा प्रकोप व्यवस्थापनको मुख्य उद्देश्य रहेको देखिन्छ। उल्लेखित उद्देश्यहरू परिपूर्ति एवं कार्यान्वयन गराउन सरकारले विभिन्न किसिमका रणनीतिहरू अपनाउनु पर्ने र यी रणनीति अनुरूपका कार्य नीतिहरू संचालन गर्नु पर्ने देखिन्छ। प्रकोप व्यवस्थापन सम्बन्धि योजना एवं नीति तयार गर्दा प्रकोप एवं वातावरणीय प्रभाव न्यूनीकरण हुने प्रविधिको प्रयोग तथा विकासमा जोड दिने, उद्धार एवं राहत कार्यलाई चारदशी बनाउने र मौजुदा भूकम्प मापन केन्द्र तथा प्रकोप व्यवस्थापनलाई अझ सुदृढीकरण बनाउने यसका रणनीतिहरू र हेका छन् भने उल्लेखित रणनीति परिपूर्तिको लागि देशव्यापी कार्य नीतिहरू अवलम्बन गर्नुपर्ने कुरा उल्लेख भएको पाइन्छ।

**दैवी प्रकोप व्यवस्थापन सम्बन्धमा राष्ट्रिय एवं अन्तर्राष्ट्रिय क्षेत्रमा भएका क्रियाकलापहरू** : सन् १९९५ मा जापानको कोबे सहर मा भएका Asian Natural Disaster Reduction Conference र त्यसपछि पटक पटक अन्य विभिन्न मुलुकहरूमा भएका बैठकहरूमा निर्णय

भएअनुसार दैवी प्रकोप सम्बन्धी सूचना, तथ्याङ्क संकलन, अध्ययन र सूचना प्रवाह गर्न र दैवी प्रकोप न्यूनीकरणका कार्यहरू सम्बन्धमा आपसी सहयोग अभिवृद्धिका लागि अध्ययन अनुसन्धान गर्न जापानको कोबेमा Asian Disaster Reduction Center (ADRC) को स्थापना भइसकेको छ। नेपालले पनि सो केन्द्रको सदस्यता ग्रहण गरेको छ। संयुक्त र राष्ट्रसंघको आह्वान अनुरूप सन् १९९० देखि १९९९ सम्म हरेक वर्षको अक्टुबर महिनाको दोस्रो बुधवारलाई अन्तरराष्ट्रिय प्राकृतिक प्रकोप न्यूनीकरण दिवस (आइ.डि.एन.डि.आर.डे) को रूपमा मनाउदै आइएको थियो। यो दिवस सन् १९९९ मा समापन भई सकेको भएतापनि यसलाई निरन्तरता दिनको लागि सन् २००० को दशकलाई हरेक वर्षको अक्टुबर महिनाको दोस्रो बुधवारलाई अन्तरराष्ट्रिय प्रकोप न्यूनीकरणका लागि राखनीति (आइ.एस.डि.आर.डे) को रूपमा मनाउदै आइएको छ। गत वर्ष "दिशो पर्यतीय विकासको लागि प्रकोप न्यूनीकरण" नारा थियो। यसको पहिलो मुख्य उद्देश्य प्रकोपलाई न्यूनीकरण गर्ने सम्बन्धमा विश्वभरी नै सफलतापूर्वक जनचेतना जगाउने थियो।

**प्रकोपका चुनौतिहरू** : जनसंख्याको अत्यधिक वृद्धि, अनियोजित वसोवास, बसाई सराई, वन विनाश, मापदण्ड विपरित घर निर्माण गर्ने प्रवृत्ति, सहरी क्षेत्रमा व्यवस्थित ढल निकास आदिको अभाव, नदि, खोला नाला, वन क्षेत्र जस्ता प्राकृतिक संपदामाथि हुने अतिक्रमण पनि प्रकोपलाई निम्त्याउने चुनौतिहरू हुन्। प्रकोपसँग सम्बन्धित निकायहरू आपसी सहयोगात्मक भावना र आपसी समन्वयको खाँचो छ। खास गरी प्रकोप भएको अवस्थामा आपसी सहयोगात्मक भावना र समन्वयले महत्वपूर्ण भूमिका खेल्दछ। यसै गरी राहत उद्धार कार्यमा सन्तुलन हुन, काममा दोहोरोपन हुन नदिन आपसी कार्यालाप र समन्वयकारीको पनि उत्तिकै महत्व छ। भौगोलिक विकटताका कारण देशका सम्पूर्ण भागमा सडक यातायातको सुविधा उपलब्ध छैन। त्यसैले प्रकोप परेका वखत पीडित पक्षलाई उद्धार गर्न एवं समयमा नै राहत सामग्री उपलब्ध गराउन सकिदैन। यसैगरी संचार सम्पर्कको अभाव पनि एउटा राष्ट्रिय चुनौतीको विषय नै बन्न पुगेको छ। बुझारोपण कार्यक्रम संचालन गर्ने, व्यवस्थित बसाई सराईको व्यवस्था मिलाउने, घर निर्माणका लागि तय गरिएको भवन आचार संहितालाई अनिवार्यरूपमा पालना गर्ने, सहरी क्षेत्रमा व्यवस्थित ढल निकासको व्यवस्था गर्ने जस्ता कुराहरूलाई प्राथमिकताका साथ पालना गरिनु पर्दछ। यसैगरी प्राकृतिक संपदामाथि कुनै पनि बर्ग र समुदाय बाट अतिक्रमण गरिनु हुदैन। अन्त्यमा प्रकोपजन्य क्षेत्रको पहिचान गरी प्रकोप नक्सांकन गर्नु र विकास योजना सँग प्रकोप हुन सक्ने संभाव्यतालाई दृष्टिगत गरी दीर्घकालिन योजनाहरू तयार गर्नु आजको खाँचो छ।



## ABSTRACT PRESENTED AT THE ISDR WORKSHOP

### Seismic Hazards in Nepal

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#### ABSTRACT

Role of seismology in seismic hazard mitigation of the country is to keep up seismic surveillance and assess seismic hazard. Department of Mines and Geology installed a country wide telemetric network of short period vertical seismic stations in 1994 with the assistance of France in the IDNDR span of national activities to carry out these functions. The microseismicity data base of the last eight years has been instrumental to work out the seismotectonic model in complexity with other geological and geophysical results. It also provides a basis to work out Probabilistic Seismic Hazard Assessment (PSHA) of the country.

Existing seismic hazard maps of Nepal derived from Probabilistic Seismic Hazard Assessment (PSHA) date to the decade of nineties of the last century (HMG-UNDP/UNCHS/ Habitat 1993; GSHAP 1999). Since then our knowledge of Nepal seismicity has improved significantly, thanks to the installation of a seismic network covering whole of Nepal territory (Pandey et al. 1999) and numerous seismotectonic investigations (Pandey et al. 1995; Bilham et al. 1997; Cattin and Avouac 2000; Lave and Avouac 2000) including those that followed some recent damaging earthquakes in the Himalaya (Uttarkashi in 1991, Chamauli in 1999). We have therefore computed a new PSHA map based on a seismotectonic model that takes advantage of these progresses. The output of the study consists of a map of peak horizontal acceleration at bedrock that has a 10% probability of being exceeded over 50 years. This map neglects the effect of surface geology on local ground motion (site effects).

### प्राकृतिक प्रकोपको कारण र यस सम्बन्धि शिक्षा र जनचेतनाको आवश्यकता

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#### सारांश

प्राकृतिक रूपमा आइपुग्ने जनघनको क्षति गर्न सक्ने दुर्घटनालाई सामान्य रूपमा प्राकृतिक प्रकोप भनी बुझिन्छ। यद्यपि प्राकृतिक प्रकोप मानवीय कारणले पनि उत्पन्न हुन सक्छ। त्यसैले प्राकृतिक प्रकोपको कारणलाई वर्गीकरण गर्दा प्राकृतिक कारण र मानव ध्वजित वा मानवीय क्याकलापबाट उत्पन्न कारणको रूपमा विभाजन गर्न सकिन्छ। यसरी वर्गीकरण गर्दा कतिपय प्राकृतिक कारणबाट उत्पन्न हुने प्रकोप र मानवीय कारणबाट उत्पन्न हुने प्रकोप एउटै प्रकृतिको हुन्छन्। त्यसकारण हामी देश नेपालमा उत्पन्न हुने प्राकृतिक प्रकोप र तिनका कारणहरू बारेमा जनस्तरमा शिक्षा र प्रभावकारी चेतनाको आवश्यकता अपरिहार्य छ।

प्राकृतिक प्रकोप सम्बन्धि जनस्तरमा शिक्षा र चेतना पुऱ्याउनु आजको सवर्षमा एक चुनौतीपूर्ण र अनिवार्य कार्य हो। प्राकृतिक प्रकोपका घटनाहरू किन घटदछन्, यसका पछाडि के कस्ता कारणहरू हुन्छन्, के कस्ता घटनाहरूमा कमी ल्याउन सकिन्छ कस्ता प्रश्नको उत्तर खोज्ने हो भने जनस्तरमा यस सम्बन्धि ज्ञान हुनु जरुरी छ। त्यसैले प्राकृतिक प्रकोपहरू जस्तै बाढी, पहिरो, भूकम्प, आगलागी इत्यादी तथा यसका

कारणहरू अवस्थित मानव बसोबास तथा खेती प्रणालीका बारेमा जनस्तर मा शिक्षाको आवश्यकता छ।

यस सम्बन्धि शिक्षा तथा जनचेतनाको आवश्यकता किन पर्छ भने शिक्षा तथा चेतना भनेको यस्तो चिज हो जसको प्रभावले बन्द भएका आँखा सकारात्मक दिशाबल्ले खुल्दछन्। प्राकृतिक प्रकोप तथा यसका कारणको बारेमा जनस्तरमा ज्ञान पुग्नु भने प्राकृतिक प्रकोप न्यूनिकरणमा धेरै सहयोग पुग्छ।

जनचेतना अभिवृद्धि गर्ने जनसंख्या शिक्षा तथा वातावरण विज्ञान जस्तै प्राकृतिक प्रकोप सम्बन्धि पाठ्यक्रम विद्यालय स्तर देखि उच्च शिक्षासम्म तयार पारी अध्ययन अध्यापन गराउने र यसको लागि सरकारी नीति बनाई तुरुन्त लागु गर्न आवश्यक छ। मानव ध्वजित प्रकोपको कारण सम्बन्धमा कडा नियम कानून बनाई अविलम्ब लागु गर्न पर्दछ।

यस सम्बन्धि जनचेतना अभिवृद्धि गर्ने कार्यक्षेत्र तोकिएको सरकारी निकाय, गैरसरकारी संस्था, विश्वविद्यालय तथा विद्यालय, संपूर्ण संचार माध्यमहरू, संपूर्ण प्रकाशन संस्था, पत्रकार तथा व्यक्ति (सम्बन्धित विषयका विज्ञहरू) ले विवेश पल्ल गर्न पर्छ।

## विज्ञान तथा प्रविधि मन्त्रालय तथा अन्य सम्बन्धीत निकायहरूमा दिएको ज्ञापन पत्र

नेपाली वैज्ञानिक तथा प्राविधिकहरूको मनोबल उच्च पार्न  
गर्नुपर्ने कार्यहरू

- १) यस नेपाल भौगर्भिक समाज लगायत अन्य वैज्ञानिक तथा प्राविधिकहरू सबैलाई प्रतिनिधित्व गर्ने आआफ्नो क्षेत्रसंग सम्बन्धीत पेशागत संगठनहरूलाई श्री ५ को सरकारले निश्चित मापदण्ड निर्धारण गरि जिल्ला प्रशासन कार्यालयमा हरेक वर्ष रिर्नु गर्ने अवस्थालाई जन्त्य गरि विज्ञान तथा प्रविधि मन्त्रालयमा दर्ता गरि यिनीहरूको हरेक कृषाकलापको अनुगमन पनि विज्ञान तथा प्रविधि मन्त्रालयबाट हुनु आवश्यक देखिन्छ।
- २) विज्ञान र प्रविधिसंग सम्बन्धीत यस्ता पेशागत संगठनहरूको कृषाकलापलाई अझ बढि प्रभावकारी बनाउनको लागि आवश्यक जग्गा, भवन लगायत अन्य सुविधाहरूमा श्री ५ को सरकारले विशेष सहयोग गर्नु पर्ने आवश्यक देखिन्छ।
- ३) श्री ५ को सरकारको विज्ञान र प्रविधिसंग सम्बन्धीत निकायहरूमा विज्ञान र प्रविधिसंग सम्बन्धीत राष्ट्रिय जलराष्ट्रियस्तरका जर्नेल लगायत अन्य पत्र-पत्रिकाहरू पढ्नो प्राथमिकताको आधारमा किनने व्यवस्था हुनु पर्दछ र सो निकायहरूले पनि त्यस्ता जर्नेलहरू प्रकाशनको लागि विशेष पहल गर्न आवश्यक देखिन्छ।
- ४) राष्ट्रिय, क्षेत्रिय तथा अन्तर्राष्ट्रियस्तरमा विज्ञान र प्रविधिको अध्ययन अनुसन्धानमा कार्यरत यस्ता संगठनहरू जस्तै श्री ५ को सरकार विज्ञान तथा प्रविधि मन्त्रालयद्वारा अवलम्बन गरि ने निश्चित मापदण्ड पूरा गर्ने सक्दछन्, त्यस्ता संगठनहरूलाई सहूलियत दरमा छिटो र छरितो तरिकाले प्रयोग गर्न दिने व्यवस्था गर्न नितान्त आवश्यक देखिन्छ।
- ५) विज्ञान तथा प्रविधि मन्त्रालयमा समै विज्ञान र प्रविधिको क्षेत्रसंग संलग्न उच्चस्तरीय प्राविधिकहरूको एउटा सेल निर्माण गर्न आवश्यक देखिन्छ।
- ६) श्री ५ को सरकारको विभिन्न निकायहरू जस्तै राष्ट्रिय योजना अयोग, विज्ञान तथा प्रविधि मन्त्रालय, वातावरण तथा जनसंख्या मन्त्रालय, स्थानिय विकास मन्त्रालय, रीताष्ट आदिमा भू-वैज्ञानिकहरू लगायत अन्य वैज्ञानिकहरूको समेत महत्वपूर्ण योगदान हुने हुनाले आवश्यक व्यवस्था हुनु पर्ने देखिन्छ।
- ७) श्री ५ को सरकार अन्तर्गत सबै निकायहरूमा सोध र विकास (R&D) संग सम्बन्धीत एकाइको व्यवस्था गर्नु पर्ने आवश्यक देखिन्छ।
- ८) श्री ५ को सरकारको विभिन्न निकायहरूमा सम्पूर्ण प्राविधिक तथा वैज्ञानिकहरूलाई उनीहरूको क्षमता अनुसार समान रूपले जिम्मेवारी प्रदान गरिने वातावरण तयार गरिनु पर्छ। तर हाल क्षमताको अभाव अलावा अन्य तक्रारत्मक प्रवृत्तिले पनि प्रथम पाइन्हेकोले यसबाट उचित प्रतिफल आउन नसकेको पाइन्छ।

- ९) श्री ५ को सरकारको विभिन्न निकायहरूबाट प्रदान गरिने छात्रवृत्ति लगायत सेमिनार, तालिम, गोष्ठी आदिमा वैज्ञानिक तथा प्राविधिकहरूलाई संलग्न गराउदा त्यस्ता प्राविधिकहरूको कार्यक्षमता र दक्षताको आधारमा गराउनु पर्ने देखिन्छ।
- १०) श्री ५ को सरकारलाई प्राप्त विभिन्न मित्र राष्ट्रबाट प्रदान गरि ने छात्रवृत्ति, तालिम, गोष्ठी आदिको प्राप्त सिट अपयोग भएकोले सो को बुद्धिको लागि विशेष पहल गर्नु पर्ने देखिन्छ।
- ११) वि.वि. लगायत अन्य विश्वविद्यालयमा कार्यरत शिक्षकहरू (प्राविधिक तथा वैज्ञानिक) लाई उपयुक्त अनुसन्धान गर्ने वातावरणको विकास गराउनु पर्ने देखिन्छ।
- १२) श्री ५ को सरकारको विभिन्न निकायहरूमा कार्यरत वैज्ञानिक तथा प्राविधिकहरूलाई कार्यालय समय बाहिर आफ्नो क्षेत्रसंग सम्बन्धीत कार्यमा निर्बाध रूपमा काम गर्न पाउनु पर्ने व्यवस्था कायम गर्न सकिँमा यस क्षेत्रमा हुने गरेका वैज्ञानिक तथा प्राविधिकहरूको पलायनलाई कम गर्न सकिन्छ।
- १३) श्री ५ को सरकार मार्फत विभिन्न दातृ राष्ट्रहरू तथा संघ-संस्थाहरूले विज्ञान तथा प्रविधिको क्षेत्रमा विभिन्न योजनाहरूमा लगानीको लागि इच्छुक भई राखेको अवस्थामा पनि श्री ५ को सरकारका निकायहरू मार्फत त्यस्ता कार्य गर्न हालको विद्यमान नीति नियमले कठिनाई हुने भएकोले त्यस्ता योजना लगायत अन्य तालिम गोष्ठी संचालन गर्न विद्यमान नीति नियममा पुनर्मूल्याङ्कन हुनु पर्ने देखिन्छ।
- १४) श्री ५ को सरकारले हाल अवलम्बन गरि राखेको प्राविधिकहरूलाई पनि श्री ५ को सरकारको विशिष्ट क्षेत्रमा कार्य गर्न पाउने अवसरहरूलाई घटावत राख्दै अझ बढि अवसरहरू प्रदान गरिनु पर्छ।
- १५) माध्यमिक विद्यालयस्तर देखि विज्ञान शिक्षामा अनिवार्य रूपमा प्रयोगात्मक परीक्षामा सामेल गराउनु पर्ने आवश्यक देखिन्छ।
- १६) श्री ५ को सरकार तथा विश्वविद्यालयका विभिन्न निकायहरूमा विभिन्न जोखिम युक्त प्रयोगशालामा काम गर्दा प्राविधिक तथा वैज्ञानिकहरूको जीवन बिमाको व्यवस्था हुनु नितान्त आवश्यक देखिन्छ।
- १७) आर्थिक अनियमितता तथा अनुशासनहीनताले गर्दा विज्ञान र प्रविधिको भूमिकालाई सशक्त बनाउन असजिलो भई राखेकोले यस प्रकारको कार्यको तुरुन्त दृष्टी कदमका साथ अन्त्य गरिनु पर्ने देखिन्छ।
- १८) देशमा ठूला भण्डार भएरपनि मागको तुलनामा उत्पादन अति न्यून भएका निम्नमूल्यी खानीजन्य उद्योगहरू खासगरी सिमेन्ट र क्विक्रिट तथा कृषि र बनमा आधारित उद्योगहरू संचालन गर्न सकिँमा युवा जनशक्तिलाई रोजगार प्रदान गरि देशको आर्थिक स्थिति सुधार्न सहयोग मिल्ने हुनाले यसको लागि पहल गर्न आवश्यक देखिन्छ।



१९. वैज्ञानिक तथा प्राविधिकहरूलाई कम्तिमा उनिहरूको परिवार धान्न सक्ने किसिमले तलब तथा भत्ता आदि सुविधाहरू उपलब्ध गराई विदेश पलायन हुनुपर्ने स्थिति रोक्नु पर्ने देखिन्छ।
२०. श्री ५ को सरकारको निकायमा कार्यरत प्राविधिक तथा वैज्ञानिकहरूको प्रमोशन अति ढिलो भई भण्डै २०/२५ वर्ष सम्म पनि एउटै पदमा बसिर रहनु पर्ने अवस्थाले प्राविधिक तथा वैज्ञानिकहरूको मनोबल बृद्धि हुन नसकेकोले यस सम्बन्धमा आवश्यक कार्य गर्नु पर्ने देखिन्छ।
२१. श्री ५ को सरकारको निकायमा प्राविधिक तथा वैज्ञानिकहरूको रिक्त पदहरू लामो समय सम्म विज्ञापन नगरि राख्ने गरेकोले समय मै वैज्ञानिक तथा प्राविधिकहरूको प्रमोशनमा कठिनाई परिरहेकोले यस प्रकारको कार्य तुरुन्त रोकिनु पर्छ।
२२. श्री ५ को सरकारको निकायहरूमा विकास बजेट विनियोजित गर्ने लगाई रकमान्तरगति अन्य प्रयोजनको लागि खर्च गर्ने गरेको पाइएकोले सहि रूपमा विकास कार्यले गतिविन नसकेको पाइएकोले यस सम्बन्धमा आवश्यक कार्य गर्नु देखिन्छ।
२३. श्री ५ को सरकारको निकायहरूमा वैज्ञानिक तथा प्राविधिकहरूको कार्य दक्षताको आधारमा प्रमोशन गर्ने परिपाटीको विकास गर्नुपर्ने देखिन्छ।
२४. श्री ५ को सरकारले गा.वि.स.हरूमा प्राविधिक सहायक स्तरका कर्मचारीहरू राख्दा घटिमा प्रविष्टता प्रमाणपत्र (Isc., I.E., Isc. AG., Isc. Forestry) तह उत्तिर्ण गरेका कर्मचारीहरू राख्नु पर्ने देखिन्छ।
२५. विज्ञान तथा प्रविधिसँग सम्बन्धीत एउटा केन्द्रिय पुस्तकालयको व्यवस्था विज्ञान तथा प्रविधि मन्त्रालयले गरिरनुपर्ने देखिन्छ।
२६. राष्ट्रिय काम गर्ने वैज्ञानिक तथा प्राविधिकहरूको मनोबल उच्च गराउने उचित सम्मान र पुरस्कारको तथा जिम्मेवारी वहन गर्ने नसक्ने वा पदीय दुरुपयोग गर्नेहरूलाई दण्डको समेत व्यवस्था हुनु पर्ने देखिन्छ।

## OTHER SUGGESTIONS AND RECOMMENDATIONS

- \* Use professional Societies in research and development of various development projects
- \* Financial and Moral Support for the publication of Scientific Journals must be provided through MOST
- \* Role of technocrats and administrator should be defined clearly
- \* Research Institute should be developed and must be provided adequate budget.
- \* Establish an environment of social respect and trust for Scientists and Technocrats.
- \* Fresh recruitment must be provided compulsory one year training related to job.
- \* Right person should be given right places as per their qualification. Related manpower must be deputed in Ministries / Department and Industries.
- \* Once the person is recruited for certain post he or she must be given the minimum facilities such as table/ chair and logistic support.
- \* The project person must be in the project till its completion and evaluation must be done accordingly for promotion and transfer.
- \* Audit of the Development Budget should be done by the technically trained in the relevant technical field auditor to avoid "Beruju".

## ● PARTICIPATION / REPRESENTATION OF NEPAL GEOLOGICAL SOCIETY IN VARIOUS PROGRAMMES

Mr. R.P. Khanal, General Secretary of NGS took part in the Inauguration Programme on International seminar on Sustainable Slope Risk Management for Roads on March 23, 2003 in Kathmandu, Nepal.

Mr. R.P. Khanal, General Secretary of NGS, took part in the Workshop on Science and Technology Policy organized by Ministry of Science and Technology on Falgun 2, 2059 in the Ministry of Science and Technology.

Mr. R.P. Khanal, General Secretary of NGS, took part in the International Seminar on Mountain Hazard Research and Mitigation from 18<sup>th</sup> to 22<sup>nd</sup> November, 2002 organized by Scott Wilson Kirkpatrick & Co. Ltd. and Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) and Department of roads, Bhutan in Kathmandu, Nepal.

On behalf of the Nepal Geological Society, Mr. Khanal, General Secretary of NGS, took part in the meeting held under the Chairmanship of Hon Minister Mr. Dharma Bahadur Thapa, Minister for Home Affairs and Chairman of Earthquake Safety Day National Committee in 22 Poush 2059 BS. The meeting was organized by the Department of Narcotics Control and Disaster Management MOH/ HMG Nepal.

Mr. R.P. Khanal, General Secretary of NGS and Mr. Basanta Kaphle, Member of the Executive Committee of NGS took part in the Earthquake Safety Day Exhibition, which was held in Bhaktapur, Nepal from Magh 2 to 5, 2059 B.S. NGS was actively involved in this Earthquake Safety Exhibition.

Mr. R.P. Khanal, General Secretary of NGS, took part in the Evening Programme on the occasion of World Water

Day and World Meteorological day on March 23, 2003, organized by the Society of Hydrologists and Meteorologists Nepal.

Mr. R.P. Khanal, General Secretary of NGS took part in the Inaugural Programme of the Soil and Water Conservation Society, Nepal (SOWCOS) in the Third Annual Meeting on Chaitra 15, 2059 at Staff College, Jawaalkhel, Nepal. As the invitees, Mr. Khanal expressed congratulation for the newly elected Executive Committee of SOWCOS.

Mr. P.S. Tater, President of NGS took part in the International Seminar on Asian Seismological Commission 2002 from 24 to 26, November 2002, Kathmandu Nepal, jointly organized by National Society for Earthquake Technology (NSET) Nepal, Asian Disaster Preparedness Centre (ADPC), Asian Seismological Commission (ASC) in Kathmandu, Nepal.

Mr. P.S. Tater, President of NGS took part in the talk Programme on Earthquake Day on 2 Magh 2059 in Janakpur, organized by the District Development Committee of Janakpur.

Mr. P.S. Tater, President of NGS took part in the one day seminar organized by Nepal Geotechnical Society on April 2003.

Mr. R.P. Khanal, General Secretary, Dr. T.N. Bhattarai, Treasurer, Mr. Ranjan Kumar Dahal and Mr. Tika Ram Paudel of NGS took part in the seminar on Distance Learning and Training in landslide Management on 27 January 2003 in Kathmandu, organized by Mountain Risk Engineering Unit, Tribhuvan University, University of Durham, UK and University of Sannio, Italy.

## ● GEOSCIENTIFIC TALK PROGRAMMES

In this Fiscal Year 2002-2003, Nepal Geological Society has organized two geo-scientific talk programs/ lectures on the following topics by inviting the distinguished international scientists and researchers.

- \* "Run out prediction for large Landslides" by Prof. Oldrich Hunger, University of British Columbia,

Vancouver, Canada on 25 October 2002 in the auditorium of DMG, in Lainchaur, Kathmandu, Nepal.

- \* Himalayan Nepal Tibet Broadband Seismic Experiment (HIMNET): Deployment and Initial Results. By: Dr. Anne Sheehan, Associate Professor, University of Colorado, USA, on 25<sup>th</sup> October 2002 in the auditorium of DMG, in Lainchaur, Kathmandu, Nepal.



## ● CALENDER OF EVENTS OF THE YEARS 2003/ 2004/ 2005

**\*Vth Hutton Symposium on the Origin of Granites and Related Rocks, Organized by Aichi University, Toyohashi, Japan on 2-6 September, 2003.**

Contact: Dr. Shunso Ishihara, President Organizing Committee, Hutton-V Office, Geological Survey of Japan, AIST Central-7, Higashi, Tsukuba, 305-8567, Japan  
Fax: +81-298-61-3742  
E-mail: Hutton-V@m.aist.go.jp  
Website: <http://www.gsj.jp/info/event/hutton>

**\*18th International Himalaya - Karakorum - Tibet Workshop is going to be held in Ascona, Switzerland on 2-4 April 2004.**

Contact: Dr. Eva Schill, Organizing Secretary, Institute für Geophysik, ETH Zentrum, Zurich, CH-8093 Zurich, Switzerland.  
Tel: ++41-1-6333667  
Fax: ++41-1-6331065  
E-mail: [schill@mag.jg.erdw.ethz.ch](mailto:schill@mag.jg.erdw.ethz.ch)

**\*Nepal Geological Society is going to organize 4th Nepal Geological Congress on 7-9 April 2004 in Kathmandu, Nepal.**

Contact: Dr. Ramesh Man Tuladhar, Convenor, 4th Nepal Geological Congress, G.P.O. Box 231, Kathmandu, Nepal.  
E-mail: [ngs@wlink.com.np](mailto:ngs@wlink.com.np)

**\*Nepal Geological Society is going to organize 5th Regional Conference on "Engineering Geology for Major Infrastructure Development and Natural Hazards Mitigation" on 28-30 September 2005 in Kathmandu, Nepal. The Conference is Co-sponsored by IAEG and Asian Regional Groups of IAEG.**

Contact: Dr. R.P. Bashyal, Convener  
Tel: 799-1-4416521  
E-mail: [ngs@wlink.com.np](mailto:ngs@wlink.com.np)

**\*BALWOIS Conference on Water Observation, and Information System for Decision Support. It will be held in Ohrid, Macedonia, 25 - 29 May 2004.**

Contact: M Pierre Hubert (Secretary of IAHS), President of the Scientific Committee and Ms Suzana Monevska (Director of Hydrometeorological Service of Republic of Macedonia), President of the International Organizing Committee, 911, Avenue Agropolis  
BP64501  
34394 - Montpellier Cedex 5 - FRANCE  
Tel: 33 4 67 63 64 20  
Fax: 33 4 67 41 21 33  
GSM: 33 6 03 222 132  
Marc Morell  
WOISYDES/BALWOIS EC Projects Coordinator  
email: [morell@ird.fr](mailto:morell@ird.fr)  
Website: <http://balwois.net>  
<http://woisydes.net>

Find necessary information related to this event on <http://balwois.net>.

The main deadlines are:

- \* 15 October 2003: Deadline for receipt of the abstracts
- \* 15 November 2003: Notification for the authors
- \* 15 February 2004: Deadline for receipt of the final presentations
- \* 25/29 May 2004: Conference

**\*An International Symposium on Renewable Energy is going to be held on August 2003, in Kathmandu.**

Contact: Prof. J.N. Shrestha, Organizing President

**\*A 9 months advance Post Graduate Training on GIS is going to be held in Dehradun, India from October 2003 to June 2004.**

**\*International Symposium on industrial minerals and building stones is going to be organized by the Turkish national group of IAEG in Istanbul, Turkey on 15 - 18 September 2003.**

For detail contact: IMBS 2003, Symposium secretariat, ODS ODS Tourism and Travel Ltd, Yildiz Cicegi Sok, 12/1, 6830 Etiler Istanbul, Turkey.

Tel: 90-212-2875800

Fax: 90-212-2634581

Website: <http://www.imbs2003.org>

**\*First International Conference on "Sustainable Development and Management of the Subsurface" is going to be organized by Delft Cluster, co-sponsored by IAEG in Utrecht, The Netherlands on 5-7 November 2003.**

For detail contact: SDMS conference 2003, Mrs. S. van der Lugt, P.O. Box 69, 2600 AB Delft, The Netherlands.

Tel: 31-15-2693794

Fax: 31-15-2693799

E-mail: [info@delftcluster.nl](mailto:info@delftcluster.nl)

Website: [www.delftcluster.nl](http://www.delftcluster.nl)

**\*4th Asian Symposium on Engineering Geology and the Environment, "Engineering Geology for Sustainable Development in Mountainous Areas" is going to be organized by the University of Hong Kong, Chengdu University of Technology and China University of Geosciences, Wuhan on 3-5 May 2004. For Detail contact: Dr. A. Aydin, Department of Earth Sciences, The University of Hong Kong SAR China**

Tel: +852-25-176912

E-mail: [IEAG-Asia@hku.hk](mailto:IEAG-Asia@hku.hk)

**\*1st European regional IAEG conference on "Professional practices and engineering geological methods in European infrastructure projects" is going to**

be organized by the IEAG national group of Belgium, Germany and the Netherlands on 4-7 May 2004.

**Contact:** Secretariat EurEnGeo 2004 C/O Robert Charlier, Department Geomac, Université de Liège, Chemin des Chevreuils 1 Batiment B 5273 4000 Liège Belgium

Tel: +32-4-3669334

Fax: +32-4-3669326

E-mail: [Robert.Charlier@ulg.ac.be](mailto:Robert.Charlier@ulg.ac.be)

"International Symposium on "The last natural disasters - New challenges for the Engineering Geology and the Geotechnics" is going to be organized by the Bulgarian national Group of IAEG.

**Contact:** Ass.Prof Kiril Anguelov, 11 Prof. G. Zlatarski Str. Vitosha Residential Estate, Sofia 1126, Bulgaria.

Tel:+359-88-555812

Fax:+359-2-685437

E-mail: [geolobby@mail.bg](mailto:geolobby@mail.bg)

## CONGRATULATIONS



N.R. Sthapit

Nepal Geological Society extends hearty congratulation to Mr. Nanda Ram Sthapit, Life Member of Nepal Geological Society and Director General of Department of Mines and Geology, who was decorated with **Suprabal Gorkha Daxin Bahu (3rd)** by His Majesty the King Gyanendra Bir Bikram Saha Dev for his achievements in 2002.



B.D. Shrestha

Nepal Geological Society extends hearty congratulation to Mr. Bishnu Das Shrestha Life Member of Nepal Geological Society, who was decorated with **Prabal Gorkha Daxin Bahu (4th)** by His Majesty the King Gyanendra Bir Bikram Saha Dev for his achievements in 2002.



B.M. Jnawali

Nepal Geological Society extends hearty congratulation to Mr. Bharat Mani Jnawali, member of Nepal Geological Society, who was decorated with **Prabal Gorkha Daxin Bahu (4th)** by His Majesty the King Gyanendra Bir Bikram Shah Dev for his achievements and contribution in Geoscience in 2003.



B.N. Upreti

Nepal Geological Society extends hearty congratulation to Prof. Dr. Bishal Nath Upreti, Life Member and Former President of Nepal Geological Society, who has been appointed as an Academecian of **Royal Nepal Academy of Science and Technology (RONAST)**, Nepal.



L.P. Poudel

Nepal Geological Society also extend herty congratulation to Dr. Lalu Prasad Poudel, Life Member of the society who was awarded **His Royal Highness the Crown Prince Science and Technology Award** by Royal Nepal Academy of Science and Technology for his research on the origin and development of Metamorphic rocks in the Nepal Himalaya.



जितेन्द्र घिमिरे

यस नेपाल भौगर्भिक समाजका आजीवन सदस्य श्री जितेन्द्र घिमिरे श्री ५ को सरकार, जलश्रोत मन्त्रालय, सिंचाई विभागको महानिर्देशक पदमा हालै पदोन्नति हुनु भएकोमा हार्दिक बधाई ज्ञापन गर्दछौं ।

नेपाल भौगर्भिक समाज परिवार



## RECENT PUBLICATIONS

Nepal Geological Society is regularly publishing its Journal of Nepal Geological Society and News Bulletin. So far the society has already published more than 30 volumes (Regular volumes and Special Issues) of the Journals and 20 volumes of News Bulletins. Recently it has published the proceedings of Third Nepal Geological Congress as Journal of Nepal Geological Society, Volume-27 (Special Issue) and Journal of NGS vol.26 and ready for sale. The proceedings includes 19 scientific / research papers on various fields of Geoscience.

### BOOKS

1. Tectonics of the Naga Parbat Syntax and the Western Himalaya, edited by M.A. Khan and P.J. Treloar, M.P. Searle and M.Q. Jan, Geological Society Special publication no.170, 492 pages hardback ISBN 1-86239-061-4. Published in march 2000. Price US\$150.00.
2. Application of Geographic Information System (GIS) for Integrated Assessment and management of Mineral Resources in North East Asia. Mineral Resources Assessment Development and Management Series Volume-7, published by UN/ ESCAP in 2001.
3. Structural Geology: A practical guide to surface and subsurface map interpretation (TextBook) by R.H. Groshong. Springer, 1999, 320pp. ISBN 3540654224, Price DEM 129/-.
4. Analytical solutions of Geohydrological Problems by G. A. Bruggeman, Elsevier, 1999, 970pp, ISBN0444818294. Price US\$465/-
5. Cambridge guides to minerals, rocks and fossils, by A. Woolley et al. Cambridge University Press, 1999, 336pp. ISBN 0521778816, Price US\$14.95.
6. Earth Science and Environment (2<sup>nd</sup> edition) by Graham R. Thompson. Saunders College Publishing 1999. ISBN 0030060486 US\$.
7. Earthquake Geotechnical Engineering (Proceedings of the 2<sup>nd</sup> International Conference, Lisbon, Portugal, 21-25 June 1999, 3 Vols.) by P. Secoe Pinto. A.A. Balkema, 1100pp. ISBN9058091163 Price US\$215/-
8. Environmental Assessment Practice Guide by Barbara Carol and Trevor Turpin. Thomas Telford Ltd. 1999. 150pp. ISBN 0727727818. Price UKL20/-
9. Flood and Landslide: Integrated Risk Assessment (Environmental Science), edited by R. Casale & C. Margottini. Springer, 1999, 450pp hardback UKL96/- ISBN 3540649816 Price DEM249/-
10. Geostatistics in Petroleum Geology by Oliver Du Burle, Continuing Education Course Notes #38. Cat. #908. The American Association of Petroleum Geologists. 1998. ISBN0891811877. Member Price US\$24/- List price US\$30/-
11. Geostatistics for Engineers and Earth Scientists by R.A. Olea. Kluwer 1999. 328pp. ISBN0792385233 Price NGL280/-
12. Geostatistics for Environmental Scientists by R. Webster & M.A. Oliver. John Wiley, 1999. 442pp. ISBN0471965537 Price US\$76.50.
13. Geotechnical Engineering: Principles & Practices, by Donald P. Coduto. Prentice Hall 1999, 750pp, hardback. ISBN013576380. Price US\$110/-
14. Groundwater pollution control, edited by K.I. Katsifarakis. WIT Press, 1999. apx 350pp. ISBN 1853126756. Price UKL112/-
15. Hydrogeology and Engineering Geology of Sinkholes and Karst. (proceedings of the 7<sup>th</sup> Multidisciplinary Conference on Harrisburg Hershey, PA, USA, 10-14 April 1999) Edited by Barry F. Beck et al. A.A. Balkema, 1999, 480pp hard back, ISBN 9058090469. Price US\$115/-
16. On the determination of sediment accumulation rates (Georesearch Forum Vol5) Edited by P. Bruns & H.C. Hass. Trans Tech Publications Ltd. 1999, 256pp. ISBN 0878498370 Price UKL58/-
17. Slope Stability by Anderson. John Wiley 1999. ISBN084934106x Price DEM 108/-
18. Soil Mechanics and Geotechnical Engineering (Proceedings of 11<sup>th</sup> Asian Regional Conference, Seoul, Korea, 16-18 Aug. 1999) edited by Sung-Wan Hong. A.A. Balkema 1999, Two vols. 900pp. Price US\$85/-
19. Soil Mechanics and Geotechnical Engineering (Proceedings of 12<sup>th</sup> African Regional Conference, Durban, 25-27 Oct 1999). Edited by Peter Day. A.A. Balkema, 1999, 3 vol. 1200pp. ISBN9058090825. Price US\$152/-
20. Mineralogy Tutorials: Interactive instruction on CD-Rom Version 2.0 by C.K. Lein. John Wiley 1998 Price

US\$49.95.

21. Dynamic Himalaya: By Prof. K. S. Vaidya, published by University press (India) Ltd. Hyderabad, Distributed by Orint Longman Limited Calcutta, New Delhi, Patna, Lucknow, Mumbai (Bombay).
22. Guide to Scientific and Technical Writing: By Prof. P.G. Cooray. 426 Mahakanda Road, Hindagala, Sri Lanka. Tel (08) 88541). Price US\$5.00.
23. Geological Field Notes and Sketches: By Prof. P.G. Cooray. 426 Mahakanda Road, Hindagala, Sri Lanka Tel (08) 88541). Price US\$5.00.
24. Critical Aspects of the Plate Tectonics Theory Vol. I: Criticism on the Plate Tectonics Theory: Edited by Prof. V. Belousov, 1990, 435 pages Price US\$50.00. ISBN 960-7457-02-1.
25. Theophrastus' Contribution to Advanced Studies in Geology Volume II: Edited by Prof. S.S. Augustithis et al, 1998, 281 pages, ISBN 960-7457-12-9. Price US\$45 (post free).
26. Atlas of granitization Textures and Processes: By S.S. Augustithis, 1993. 500 pages, ISBN 960-7457-08-0. Price US\$75. (Post free).
27. Magma – Crust Interactions and evolution (Geochemical and Geophysical Aspects of the Interactions and Evolution of Magmas and Rocks of the Crust): Edited by prof. B. Bonin et al 1989, 362 Pages, Price US\$38.00 (post free).
28. Atlas of the Textural Patterns of Metamorphosed (Transformed and deformed) Rocks and Their Genetic Significance: By S.S. Augustithis 1985, 401 pages Price US\$65.00 post free).
29. Practical Applications of Trace Elements and Isotopes to Environmental Biogeochemistry and Mineral Resources Evaluation. Edited by Prof. R. W. Hurst et al. 1987, 254 pages. Price US\$30.00 (Post free).
30. A Global Geology by P.W. Harben and M. Kuzvart, 1997 Price US\$198
31. Biodiversity in the Eastern Himalayas: Conservation through dialogue (2002) Edt. By Chen Guangwei. ICIMOD Publication.
32. Water and Erosion studies of PARDYP Nepal: Data of the Yarsha Khola watershed (ICIMOD publication, 2002)

## JOURNALS

Journal of Nepal Geological Society Vol. 28 is in the process of publication.

Journal of Nepal Geological Society volume 27 (Special Issue). Proceedings of 3<sup>rd</sup> Nepal Geological Congress held on 26-28 September 2001 in Kathmandu, Nepal published in May 2003 (in circulation).

Journal of Nepal Geological Society volume 26, published in June 2002 (in circulation).

Journal of Nepal Geological Society volume 25, December 2001 (in circulation)

## PROCEEDINGS

Proceedings of 3<sup>rd</sup> Nepal Geological Congress (Journal of Nepal Geological Society Vol. 27, May 2003) held on 26-28 September 2001, Kathmandu, Nepal

Proceedings of 4<sup>th</sup> SOUTH ASIA GEOLOGICAL CONGRESS (GEOSAS IV), held in New Delhi, India on 13 – 16 October November 2002.

## AWARENESS ABOUT DISASTERS

Following awareness booklets and reports are available in the Library of NGS for consultation.

\*Bhuichalo Bata Kasari Jogine (in Nepali). Published by NGS, 1996.

\*Earthquake Scenario of Kathmandu, Valley. Published by NSET-Nepal, 1998.

\*Comprehensive data Base (Basic Information) on Natural Disaster Management Capabilities in Nepal.

Report prepared by K.P. Kaphle and M. Nakarmi/ NGS for UNDP/DMS, Kathmandu, Nepal, 1997.

\*Badhi Pahiro Binas Bata Kasari Jogine (in Nepali). Published by Luthran World Federation, Kathmandu, Nepal, 2055BS.

\*Aaglagiko Binas Bata Roktham, Purba Tayari tatha Niyantranka Upayaharu 2054. published by Luthran World Federation, Kathmandu, Nepal, 2054BS.



**\*26 Things that help you to survive in an Earthquake  
(by LWF)**

*(a) During an Earthquake:*

1. Stay Calm
2. **Inside** : Stand in a door way, or crouch under a desk or Table, away from Windows or glass dividers.
3. **Outside**: Stand away from buildings, trees, telephone and electric lines.
4. **On the Road**: Drive away from underpasses/ overpasses; stop in safe area; Stay in vehicle.

*(b) After an Earthquake:*

1. Check for injuries and try your best to provide first aid
2. Check for safety for gas, water, sewage breaks; check for downed electric lines and shorts; turn off appropriate utilities; check for building damage and potential safety problems during after shocks such as cracks around chimney and foundation.
3. Clean up dangerous spills
4. Wear shoes
5. Turn on radio and listen for instructions from public safety agencies.
6. Do not use the telephone except for emergency use.

*(c) 13 Survival items to keep on Hand:*

1. Portable radio with extra batteries.
2. Flashlight with extra batteries.
3. Fire Aid Kit-including specific medicines needed for members of your household.
4. First Aid book.
5. Fire extinguisher.
6. Adjustable wrench for turning of gas and water.
7. Portable fire escape ladder for homes/ apartments with multiple floors.
8. Bottled water- sufficient for the number of members in your household.
9. Canned and dried foods sufficient for a week for each member of your household.
10. Non-electric Can opener.
11. Portable stove such as butane or charcoal.
12. Matches.
13. Telephone numbers of police, fire and doctor.

*(d) Things you need to know:*

1. How to run off gas, water and electricity
2. First Aid.
3. Plan for reuniting your family

*(Source: Lutheran World Federation, Nepal- Disaster Preparedness Project, Kathmandu)*

## ANNOUNCEMENT

We are pleased to announce that the Nepal Geological Society is going to organize 4<sup>th</sup> in its series a 3-day 4<sup>th</sup> Nepal Geological Congress on 7 to 9<sup>th</sup> April 2004 in Kathmandu, Nepal. All our members are requested for their kind co-operation and necessary helps to make the congress a grand success. All the interested persons are also requested to contact Dr. Ramesh Man Tuladhar, Convener of the Congress and Mr. Rajendra Prasad Khanal, General Secretary NGS for necessary information. First Circular regarding the Congress has been already distributed. Please note our contact numbers:

Telephone numbers: 977-1-411396

E-mail: [ngs@wlink.com.np](mailto:ngs@wlink.com.np) / [nepgeosoc@wlink.com.np](mailto:nepgeosoc@wlink.com.np)



## International Strategy For Disaster Reduction Day For Safety Of Human Lives

By Rajendra P. Khanal

THE United Nations General Assembly defined a decade from 1990 to 1999 as the International Decade for Natural Disaster Reduction (IDNDR) in 1987 and adopted a resolution to drastically reduce damage from natural disasters. IDNDR started in 1990 as one of the major activities of the United Nations. The second Wednesday of the October was declared the IDNDR Day.

### Cooperation

The IDNDR Day has been observed in Nepal since 1991 by organising meetings, seminars and training programmes. These programmes often receive a national focus and many governmental and non-governmental organisations have been involved.

The Nepal Geological Society (NGS) had, over the years been working in close cooperation with the IDNDR National Committee, Ministry of Home Affairs, UNDP/Nepal and Lutheran World Service Nepal in fulfilling the goals of IDNDR.

Nepal is a disaster prone country in the world. Because of her location characterised by rugged topography, very steep slope, variable climatic conditions, complex geological structures with active tectonic process and continued seismic activities, the country is prone to various types of natural hazards. These vary from snow avalanches and glacier lake outburst to flood (GLOF) in the higher Himalayas to fire and flood in the rest of the country. Landslides and earthquakes are frequent. They are causing extensive damage to the national economy and incurring heavy loss of lives and property every year. So many government and non-government organisations are involved in the disaster reduction and mitigation works in Nepal.

The concept of IDNDR has been

instrumental in transferring the emphasis from relief and rescue to preparedness. Various agencies of His Majesty's Government of Nepal like Ministry of Home Affairs, Department of Narcotics Control and Disaster Management, Department of Water Induced Disaster Prevention, Department of Soil Conservation etc. are active in disaster prevention, mitigation and management works in close cooperation with various international agencies such as United Nations Development Programme (UNDP), Japan International Cooperation Agency (JICA), Asian Disaster Reduction Centre (ADRC), Asian Disaster Preparedness Centre (ADPC), International Centre for Integrated Mountain Development (ICIMOD), International Red Cross Society (IRCS), United Mission to Nepal (UMN), Cooperation for American Relief Everywhere (CARE), World Food Programme (WFP), Save the Children Fund (SCF), Technical Cooperation of the Federal Republic of Germany (GTZ), Lutheran World Service (LWS), OXFAM etc. Besides these, various other professional and non-governmental organisations like Nepal Geological Society, Nepal Red Cross Society, Nepal Engineers' Association and NSET Nepal have also been providing highly valuable support to the natural disaster mitigation and management works in Nepal.

Based on the lessons from the International Decade for Natural Disaster Reduction (IDNDR), the UN has established the International Strategy for Disaster Reduction (ISDR) as a global framework for action with a view to enabling all Societies to become resilient to the effects of natural hazards and related technological and environmental disasters in order to reduce human, economic and social losses. It involves a conceptual shift from an emphasis on disaster response to the management of risk through the integration of disaster

reduction into sustainable development.

The implementation of the Strategy is premised at the establishment of partnerships between governments, non-government organisations, UN agencies, the scientific community, the media as well as other relevant stakeholders in the disaster reduction community.

The four goals of the strategy are to increase public awareness about disaster reduction to obtain commitment from public authorities to stimulate inter-disciplinary and inter-sectoral partnerships, and to improve the scientific knowledge of the causes of natural disasters and the consequences of the impact of natural hazards.

National Participation, as the primary ingredient for sub-regional, regional and international cooperation with regard to natural disaster reduction is a critical factor of the success of the ISDR. 'ISDR National Committee' or 'ISDR Focal Point' is designated by the government of each country and serve as an interface between national and international levels within ISDR. In any event the national platform should be kept informed and copied on all relevant correspondence between the Secretariat and contacts at national level.

### Involvement

ISDR Day has been proposed by the UN for second Wednesday of October of every year from 2001. The Nepal Geological Society observed ISDR Day by conducting a seminar on natural disaster reduction in cooperation with Ministry of Home Affairs and UNDP/Nepal. All concerned authorities of HMG of Nepal, all relevant consulting firms, NGOs and INGOs and professional organisations as well as local political activists of all municipalities of Kathmandu Valley are actively involved in the seminar.



Kathmandu • Thursday, October 10, 2002

The Rising Nepal

# Over 440 dead in aftermath of rains

By Rameshwar Yadav

KATHMANDU, Oct 9: More than 440 people lost their lives and 55,737 families were affected along with a huge amount of property destroyed or damaged by the rains and floods in the country this year, Secretary at the Ministry of Home Affairs Tika Dutt Niraula said.

Speaking at a seminar 'Disaster Reduction for Sustainable Mountain Development', organised on the occasion of International Strategy for Disaster Reduction Day 2002, the country has been facing problems in rescue and mitigation of disasters due to difficult geographical structure, inadequate communication facilities, technological gap, institutional weakness and lack of co-ordination among the organisations working for disaster management.

"We cannot utterly prevent the natural calamities but creating the awareness among the public about

the disaster and its possible way of the mitigation of it," he said.

The seminar was organised by Nepal Geological Society (NGS) in collaboration with Ministry of Home Affairs and other related departments.

Chief guest and member of the National Planning Commission (NPC) Dr. Jagdish Chandra Pokharel said that natural disasters such as floods, landslides, earthquakes, fire and epidemics are common phenomenon causing considerable loss of life and property in the country every year.

"Among the natural calamities, floods and landslides cannot be prevented because of scarcity of resources and funds," he said, adding that scientists, people working in this field, and the civil society should work together to reduce the effect of natural disaster.

He claimed that scientists in Nepal often remain

passive, and they do not play their role as they should have to prevent it. "Nepal lies in a sensitive zone, and natural disaster of unpredictable dimension could happen here."

Coordinator of NGS-ISDR Council Ramesh Kumar Aryal said that they should learn from the traditional wisdom of the people living in the mountains to cope up with natural disasters and other hazards in the mountains.

He said that because of the complex geological and fragile structure of soil, the country has been witnessing huge losses of life and property caused by earthquakes, floods, landslides, soil erosion, and the glacial lake outburst flood (GLOF).

President of NGS Pratap Singh Tam, Director General of Department of Mines and Geology, N.R. Shrivastava and general secretary of NGS Rajendra Prasad Khanal also spoke on the occasion.



## OBITUARY

### Late Dr. Toni Hagen



17 August 1917-April 2003

Place of Birth:

Lusarn, Switzerland

Education:

M.Sc and Ph.D (Geology)

Profession:

Geologist/ Geomorphologist

Award:

Birendra Pragyalkar from Royal Nepal academy

Distinguished Person of Kathmandu from Kathmandu Metropolitan Municipality

First visit to Nepal:

1950

Recognized as an specialist in Nepal

Publications:

- (1) Kingdom of Nepal
- (2) The Memory of Nepal (1950 – 1992)
- (3) Documentary film about Nepal.  
Nepal with lots of beautiful photographs showing natural beauty of Nepal Himalaya.



Place of Birth:

Bhojpur Nepal

28 December 1951–9 July 2003

Education:

M.Sc. (Physics)

Ph.D. (Geophysics) from Roorkee University, India (1990)

Office:

Central Department of Physics, Tribhuvan University, Kathmandu, Nepal

Professional Experience:

Teaching and Research since 1977.



## Reducing Earthquake Risk means:

1. Improving emergency response planning and capability.
2. Improving awareness of issues relating to earthquake risk.
3. Integrating seismic resistance into the process of new construction.
4. Improving the earthquake safety of school children and school buildings
5. Improving the seismic performance of existing buildings.
6. Improving the seismic performance of utility and transportation systems.
7. Increasing experts' knowledge of the earthquake phenomenon, vulnerability, consequences and mitigation techniques.
8. Preparing for long-term community recovery following damaging earthquakes.

*NSET aims to assist all communities in Nepal to become safer against earthquake by 2020 AD by developing and implementing organized approaches to managing earthquake risk.*

We understand that this challenge can be achieved only through partnership between communities and institutions.

**For further details, please contact:**



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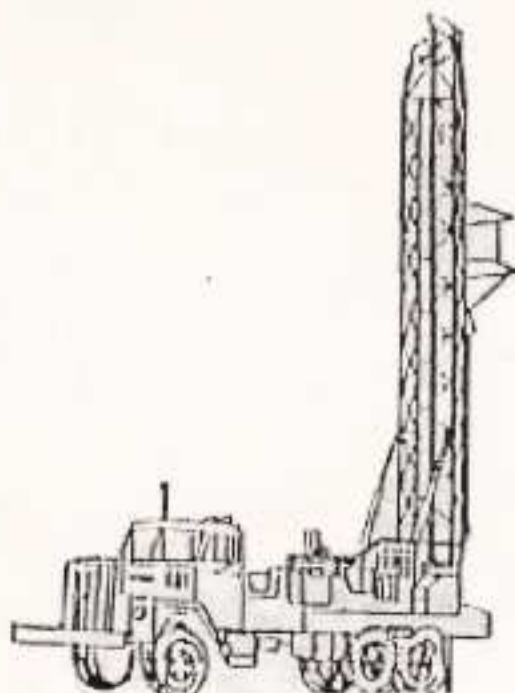
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## विज्ञान तथा प्रविधि मन्त्रालय तथा अन्य सम्बन्धीत निकायहरूमा दिएको ज्ञापन पत्र

नेपाली वैज्ञानिक तथा प्राविधिकहरूको मनोबल उच्च पार्न  
गर्नुपर्ने कार्यहरू

- १) यस नेपाल भौगर्भिक समाज लगायत अन्य वैज्ञानिक तथा प्राविधिकहरू सबैलाई प्रतिनिधित्व गर्ने आआफ्नो क्षेत्रसँग सम्बन्धीत पेशागत संगठनहरूलाई श्री ५ को सरकारले निश्चित मापदण्ड निर्धारण गरि जिल्ला प्रशासन कार्यालयमा हरेक वर्ष रिन्तु गर्ने अवस्थालाई जन्त्य गरि विज्ञान तथा प्रविधि मन्त्रालयमा दर्ता गरि यिनीहरूको हरेक कृषाकलापको अनुगमन पनि विज्ञान तथा प्रविधि मन्त्रालयबाट हुनु आवश्यक देखिन्छ।
- २) विज्ञान र प्रविधिसँग सम्बन्धीत यस्ता पेशागत संगठनहरूको कृषाकलापलाई अझ बढि प्रभावकारी बनाउनको लागि आवश्यक जग्गा, भवन लगायत अन्य सुविधाहरूमा श्री ५ को सरकारले विशेष सहयोग गर्नु पर्ने आवश्यक देखिन्छ।
- ३) श्री ५ को सरकारको विज्ञान र प्रविधिसँग सम्बन्धीत निकायहरूमा विज्ञान र प्रविधिसँग सम्बन्धीत राष्ट्रिय जलराष्ट्रियस्तरका जर्नेल लगायत अन्य पत्र-पत्रिकाहरू पढ्नो प्राथमिकताको आधारमा किनने व्यवस्था हुनु पर्दछ र सो निकायहरूले पनि त्यस्ता जर्नेलहरू प्रकाशनको लागि विशेष पहल गर्न आवश्यक देखिन्छ।
- ४) राष्ट्रिय, क्षेत्रिय तथा अन्तर्राष्ट्रियस्तरमा विज्ञान र प्रविधिको अध्ययन अनुसन्धानमा कार्यरत यस्ता संगठनहरू जस्तै श्री ५ को सरकार विज्ञान तथा प्रविधि मन्त्रालयद्वारा अवलम्बन गरि ने निश्चित मापदण्ड पूरा गर्ने सक्दछन्, त्यस्ता संगठनहरूलाई सहूलियत दरमा छिटो र छरितो तरिकाले प्रयोग गर्न दिने व्यवस्था गर्न नितान्त आवश्यक देखिन्छ।
- ५) विज्ञान तथा प्रविधि मन्त्रालयमा समै विज्ञान र प्रविधिको क्षेत्रसँग संलग्न उच्चस्तरीय प्राविधिकहरूको एउटा सेल निर्माण गर्न आवश्यक देखिन्छ।
- ६) श्री ५ को सरकारको विभिन्न निकायहरू जस्तै राष्ट्रिय योजना अयोग, विज्ञान तथा प्रविधि मन्त्रालय, वातावरण तथा जनसंख्या मन्त्रालय, स्थानिय विकास मन्त्रालय, रीताष्ट आदिमा भू-वैज्ञानिकहरू लगायत अन्य वैज्ञानिकहरूको समेत महत्वपूर्ण योगदान हुने हुनाले आवश्यक व्यवस्था हुनु पर्ने देखिन्छ।
- ७) श्री ५ को सरकार अन्तर्गत सबै निकायहरूमा सोध र विकास (R&D) सँग सम्बन्धीत एकाइको व्यवस्था गर्नु पर्ने आवश्यक देखिन्छ।
- ८) श्री ५ को सरकारको विभिन्न निकायहरूमा सम्पूर्ण प्राविधिक तथा वैज्ञानिकहरूलाई उनीहरूको क्षमता अनुसार समान रूपले जिम्मेवारी प्रदान गरिने वातावरण तयार गरिनु पर्छ। तर हाल क्षमताको अभाव अलावा अन्य तक्रारत्मक प्रवृत्तिले पनि प्रथम पाइन्हेकोले यसबाट उचित प्रतिफल आउन नसकेको पाइन्छ।

- ९) श्री ५ को सरकारको विभिन्न निकायहरूबाट प्रदान गरिने छात्रवृत्ति लगायत सेमिनार, तालिम, गोष्ठी आदिमा वैज्ञानिक तथा प्राविधिकहरूलाई संलग्न गराउदा त्यस्ता प्राविधिकहरूको कार्यक्षमता र दक्षताको आधारमा गराउनु पर्ने देखिन्छ।
- १०) श्री ५ को सरकारलाई प्राप्त विभिन्न मित्र राष्ट्रबाट प्रदान गरि ने छात्रवृत्ति, तालिम, गोष्ठी आदिको प्राप्त सिट अपयोग भएकोले सो को बुद्धिको लागि विशेष पहल गर्नु पर्ने देखिन्छ।
- ११) वि.वि. लगायत अन्य विश्वविद्यालयमा कार्यरत शिक्षकहरू (प्राविधिक तथा वैज्ञानिक) लाई उपयुक्त अनुसन्धान गर्ने वातावरणको विकास गराउनु पर्ने देखिन्छ।
- १२) श्री ५ को सरकारको विभिन्न निकायहरूमा कार्यरत वैज्ञानिक तथा प्राविधिकहरूलाई कार्यालय समय बाहिर आफ्नो क्षेत्रसँग सम्बन्धीत कार्यमा निर्बाध रूपमा काम गर्न पाउनु पर्ने व्यवस्था कायम गर्न सकिँमा यस क्षेत्रमा हुने गरेका वैज्ञानिक तथा प्राविधिकहरूको पलायनलाई कम गर्न सकिन्छ।
- १३) श्री ५ को सरकार मार्फत विभिन्न दातृ राष्ट्रहरू तथा संघ-संस्थाहरूले विज्ञान तथा प्रविधिको क्षेत्रमा विभिन्न योजनाहरूमा लगानीको लागि इच्छुक भई राखेको अवस्थामा पनि श्री ५ को सरकारका निकायहरू मार्फत त्यस्ता कार्य गर्न हालको विद्यमान नीति नियमले कठिनाई हुने भएकोले त्यस्ता योजना लगायत अन्य तालिम गोष्ठी संचालन गर्न विद्यमान नीति नियममा पुनर्मूल्याङ्कन हुनु पर्ने देखिन्छ।
- १४) श्री ५ को सरकारले हाल अवलम्बन गरि राखेको प्राविधिकहरूलाई पनि श्री ५ को सरकारको विशिष्ट क्षेत्रमा कार्य गर्न पाउने अवसरहरूलाई घटावत राख्दै अझ बढि अवसरहरू प्रदान गरिनु पर्छ।
- १५) माध्यमिक विद्यालयस्तर देखि विज्ञान शिक्षामा अनिवार्य रूपमा प्रयोगात्मक परीक्षामा सामेल गराउनु पर्ने आवश्यक देखिन्छ।
- १६) श्री ५ को सरकार तथा विश्वविद्यालयका विभिन्न निकायहरूमा विभिन्न जोखिम युक्त प्रयोगशालामा काम गर्दा प्राविधिक तथा वैज्ञानिकहरूको जीवन बिमाको व्यवस्था हुनु नितान्त आवश्यक देखिन्छ।
- १७) आर्थिक अनियमितता तथा अनुशासनहीनताले गर्दा विज्ञान र प्रविधिको भूमिकालाई सशक्त बनाउन असजिलो भई राखेकोले यस प्रकारको कार्यको तुरुन्त दृष्टी कदमका साथ अन्य गरिनु पर्ने देखिन्छ।
- १८) देशमा ठूला भण्डार भएरपनि मागको तुलनामा उत्पादन अति न्यून भएका निम्नमूल्यी खानीजन्य उद्योगहरू खासगरी सिमेन्ट र क्विक्रिट तथा कृषि र बनमा आधारित उद्योगहरू संचालन गर्न सकिँमा युवा जनशक्तिलाई रोजगार प्रदान गरि देशको आर्थिक स्थिति सुधार्न सहयोग मिल्ने हुनाले यसको लागि पहल गर्न आवश्यक देखिन्छ।

१९. वैज्ञानिक तथा प्राविधिकहरूलाई कम्तिमा उनिहरूको परिवार धान्न सक्ने किसिमले तलब तथा भत्ता आदि सुविधाहरू उपलब्ध गराई विदेश पलायन हुनुपर्ने स्थिति रोक्नु पर्ने देखिन्छ।
२०. श्री ५ को सरकारको निकायमा कार्यरत प्राविधिक तथा वैज्ञानिकहरूको प्रमोशन अति ढिलो भई भण्डै २०/२५ वर्ष सम्म पनि एउटै पदमा बसिर रहनु पर्ने अवस्थाले प्राविधिक तथा वैज्ञानिकहरूको मनोबल बृद्धि हुन नसकेकोले यस सम्बन्धमा आवश्यक कार्य गर्नु पर्ने देखिन्छ।
२१. श्री ५ को सरकारको निकायमा प्राविधिक तथा वैज्ञानिकहरूको रिक्त पदहरू लामो समय सम्म विज्ञापन नगरि राख्ने गरेकोले समय मै वैज्ञानिक तथा प्राविधिकहरूको प्रमोशनमा कठिनाई परिरहेकोले यस प्रकारको कार्य तुरुन्त रोकिनु पर्छ।
२२. श्री ५ को सरकारको निकायहरूमा विकास बजेट विनियोजित गर्ने लगाई रकमान्तरगर्ग अन्य प्रयोजनको लागि खर्च गर्ने गरेको पाइएकोले सहि रूपमा विकास कार्यले गतिविन नसकेको पाइएकोले यस सम्बन्धमा आवश्यक कार्य गर्नु देखिन्छ।
२३. श्री ५ को सरकारको निकायहरूमा वैज्ञानिक तथा प्राविधिकहरूको कार्य दक्षताको आधारमा प्रमोशन गर्ने परिपाटीको विकास गर्नुपर्ने देखिन्छ।
२४. श्री ५ को सरकारले गा.वि.स.हरूमा प्राविधिक सहायक स्तरका कर्मचारीहरू राख्दा घटिमा प्रविष्टता प्रमाणपत्र (Isc., I.E., Isc. AG., Isc. Forestry) तह उत्तिर्ण गरेका कर्मचारीहरू राख्नु पर्ने देखिन्छ।
२५. विज्ञान तथा प्रविधिसँग सम्बन्धीत एउटा केन्द्रिय पुस्तकालयको व्यवस्था विज्ञान तथा प्रविधि मन्त्रालयले गरिनुपर्ने देखिन्छ।
२६. राष्ट्रो काम गर्ने वैज्ञानिक तथा प्राविधिकहरूको मनोबल उच्च गराउने उचित सम्मान र पुरस्कारको तथा जिम्मेवारी वहन गर्ने नसक्ने वा पदीय दुरुपयोग गर्नेहरूलाई दण्डको समेत व्यवस्था हुनु पर्ने देखिन्छ।

## OTHER SUGGESTIONS AND RECOMMENDATIONS

- \* Use professional Societies in research and development of various development projects
- \* Financial and Moral Support for the publication of Scientific Journals must be provided through MOST
- \* Role of technocrats and administrator should be defined clearly
- \* Research Institute should be developed and must be provided adequate budget.
- \* Establish an environment of social respect and trust for Scientists and Technocrats.
- \* Fresh recruitment must be provided compulsory one year training related to job.
- \* Right person should be given right places as per their qualification. Related manpower must be deputed in Ministries / Department and Industries.
- \* Once the person is recruited for certain post he or she must be given the minimum facilities such as table/ chair and logistic support.
- \* The project person must be in the project till its completion and evaluation must be done accordingly for promotion and transfer.
- \* Audit of the Development Budget should be done by the technically trained in the relevant technical field auditor to avoid "Beruju".



## ● PARTICIPATION / REPRESENTATION OF NEPAL GEOLOGICAL SOCIETY IN VARIOUS PROGRAMMES

Mr. R.P. Khanal, General Secretary of NGS took part in the Inauguration Programme on International seminar on Sustainable Slope Risk Management for Roads on March 23, 2003 in Kathmandu, Nepal.

Mr. R.P. Khanal, General Secretary of NGS, took part in the Workshop on Science and Technology Policy organized by Ministry of Science and Technology on Falgun 2, 2059 in the Ministry of Science and Technology.

Mr. R.P. Khanal, General Secretary of NGS, took part in the International Seminar on Mountain Hazard Research and Mitigation from 18<sup>th</sup> to 22<sup>nd</sup> November, 2002 organized by Scott Wilson Kirkpatrick & Co. Ltd. and Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) and Department of roads, Bhutan in Kathmandu, Nepal.

On behalf of the Nepal Geological Society, Mr. Khanal, General Secretary of NGS, took part in the meeting held under the Chairmanship of Hon Minister Mr. Dharma Bahadur Thapa, Minister for Home Affairs and Chairman of Earthquake Safety Day National Committee in 22 Poush 2059 B.S. The meeting was organized by the Department of Narcotics Control and Disaster Management MOH/ HMG Nepal.

Mr. R.P. Khanal, General Secretary of NGS and Mr. Basanta Kaphle, Member of the Executive Committee of NGS took part in the Earthquake Safety Day Exhibition, which was held in Bhaktapur, Nepal from Magh 2 to 5, 2059 B.S. NGS was actively involved in this Earthquake Safety Exhibition.

Mr. R.P. Khanal, General Secretary of NGS, took part in the Evening Programme on the occasion of World Water

Day and World Meteorological day on March 23, 2003, organized by the Society of Hydrologists and Meteorologists Nepal.

Mr. R.P. Khanal, General Secretary of NGS took part in the Inaugural Programme of the Soil and Water Conservation Society, Nepal (SOWCOS) in the Third Annual Meeting on Chaitra 15, 2059 at Staff College, Jawaalkhel, Nepal. As the invitees, Mr. Khanal expressed congratulation for the newly elected Executive Committee of SOWCOS.

Mr. P.S. Tater, President of NGS took part in the International Seminar on Asian Seismological Commission 2002 from 24 to 26, November 2002, Kathmandu Nepal, jointly organized by National Society for Earthquake Technology (NSET) Nepal, Asian Disaster Preparedness Centre (ADPC), Asian Seismological Commission (ASC) in Kathmandu, Nepal.

Mr. P.S. Tater, President of NGS took part in the talk Programme on Earthquake Day on 2 Magh 2059 in Janakpur, organized by the District Development Committee of Janakpur.

Mr. P.S. Tater, President of NGS took part in the one day seminar organized by Nepal Geotechnical Society on April 2003.

Mr. R.P. Khanal, General Secretary, Dr. T.N. Bhattarai, Treasurer, Mr. Ranjan Kumar Dahal and Mr. Tika Ram Paudel of NGS took part in the seminar on Distance Learning and Training in landslide Management on 27 January 2003 in Kathmandu, organized by Mountain Risk Engineering Unit, Tribhuvan University, University of Durham, UK and University of Sannio, Italy.

## ● GEOSCIENTIFIC TALK PROGRAMMES

In this Fiscal Year 2002-2003, Nepal Geological Society has organized two geo-scientific talk programs/ lectures on the following topics by inviting the distinguished international scientists and researchers.

- \* "Run out prediction for large Landslides" by Prof. Oldrich Hunger, University of British Columbia,

Vancouver, Canada on 25 October 2002 in the auditorium of DMG, in Lainchaur, Kathmandu, Nepal.

- \* Himalayan Nepal Tibet Broadband Seismic Experiment (HIMNET): Deployment and Initial Results. By: Dr. Anne Sheehan, Associate Professor, University of Colorado, USA, on 25<sup>th</sup> October 2002 in the auditorium of DMG, in Lainchaur, Kathmandu, Nepal.

## ● CALENDER OF EVENTS OF THE YEARS 2003/ 2004/ 2005

**\*Vth Hutton Symposium on the Origin of Granites and Related Rocks, Organized by Aichi University, Toyohashi, Japan on 2-6 September, 2003.**

Contact: Dr. Shunso Ishihara, President Organizing Committee, Hutton-V Office, Geological Survey of Japan, AIST Central-7, Higashi, Tsukuba, 305-8567, Japan  
Fax: +81-298-61-3742  
E-mail: Hutton-V@m.aist.go.jp  
Website: <http://www.gsj.jp/info/event/hutton>

**\*18th International Himalaya – Karakorum – Tibet Workshop is going to be held in Ascona, Switzerland on 2-4 April 2004.**

Contact: Dr. Eva Schill, Organizing Secretary, Institute für Geophysik, ETH Zentrum, Zurich, CH-8093 Zurich, Switzerland.  
Tel: ++41-1-6333667  
Fax: ++41-1-6331065  
E-mail: [schill@mag.jg.erdw.ethz.ch](mailto:schill@mag.jg.erdw.ethz.ch)

**\*Nepal Geological Society is going to organize 4th Nepal Geological Congress on 7-9 April 2004 in Kathmandu, Nepal.**

Contact: Dr. Ramesh Man Tuladhar, Convenor, 4th Nepal Geological Congress, G.P.O. Box 231, Kathmandu, Nepal.  
E-mail: [ngs@wlink.com.np](mailto:ngs@wlink.com.np)

**\*Nepal Geological Society is going to organize 5th Regional Conference on "Engineering Geology for Major Infrastructure Development and Natural Hazards Mitigation" on 28-30 September 2005 in Kathmandu, Nepal. The Conference is Co-sponsored by IAEG and Asian Regional Groups of IAEG.**

Contact: Dr. R.P. Bashyal, Convener  
Tel: 799-1-4416521  
E-mail: [ngs@wlink.com.np](mailto:ngs@wlink.com.np)

**\*BALWOIS Conference on Water Observation, and Information System for Decision Support. It will be held in Ohrid, Macedonia, 25 - 29 May 2004.**

Contact: M Pierre Hubert (Secretary of IAHS), President of the Scientific Committee and Ms Suzana Monevska (Director of Hydrometeorological Service of Republic of Macedonia), President of the International Organizing Committee, 911, Avenue Agropolis  
BP64501  
34394 - Montpellier Cedex 5 - FRANCE  
Tel: 33 4 67 63 64 20  
Fax: 33 4 67 41 21 33  
GSM: 33 6 03 222 132  
Marc Morell  
WOISYDES/BALWOIS EC Projects Coordinator  
email: [morell@ird.fr](mailto:morell@ird.fr)  
Website: <http://balwois.net>  
<http://woisydes.net>

Find necessary information related to this event on <http://balwois.net>.

The mean deadlines are:

\* 15 October 2003: Deadline for receipt of the abstracts

\* 15 November 2003: Notification for the authors

\* 15 February 2004: Deadline for receipt of the final presentations

\* 25/29 May 2004: Conference

**\*An International Symposium on Renewable Energy is going to be held on August 2003, in Kathmandu.**

Contact: Prof. J.N. Shrestha, Organizing President

**\*A 9 months advance Post Graduate Training on GIS is going to be held in Dehradun, India from October 2003 to June 2004.**

**\*International Symposium on industrial minerals and building stones is going to be organized by the Turkish national group of IAEG in Istanbul, Turkey on 15-18 September 2003.**

For detail contact: IMBS 2003, Symposium secretariat, ODS ODS Tourism and Travel Ltd, Yildiz Cicegi Sok, 12/1, 6830 Etiler Istanbul, Turkey.

Tel: 90-212-2875800

Fax: 90-212-2634581

Website: <http://www.imbs2003.org>

**\*First International Conference on "Sustainable Development and Management of the Subsurface" is going to be organized by Delft Cluster, co-sponsored by IAEG in Utrecht, The Netherlands on 5-7 November 2003.**

For detail contact: SDMS conference 2003, Mrs. S. van der Lugt, P.O. Box 69, 2600 AB Delft, The Netherlands.

Tel: 31-15-2693794

Fax: 31-15-2693799

E-mail: [info@delftcluster.nl](mailto:info@delftcluster.nl)

Website: [www.delftcluster.nl](http://www.delftcluster.nl)

**\*4th Asian Symposium on Engineering Geology and the Environment, "Engineering Geology for Sustainable Development in Mountainous Areas" is going to be organized by the University of Hong Kong, Chengdu University of Technology and China University of Geosciences, Wuhan on 3-5 May 2004. For Detail contact: Dr. A. Aydin, Department of Earth Sciences, The University of Hong Kong SAR China**

Tel: +852-25-176912

E-mail: [IEAG-Asia@hku.hk](mailto:IEAG-Asia@hku.hk)

**\*1st European regional IAEG conference on "Professional practices and engineering geological methods in European infrastructure projects" is going to**



be organized by the IEAG national group of Belgium, Germany and the Netherlands on 4-7 May 2004.

**Contact:** Secretariat EurEnGeo 2004 C/O Robert Charlier, Department Geomac, Université de Liège, Chemin des Chevreuils 1 Batiment B 5273 4000 Liège Belgium

Tel: +32-4-3669334

Fax: +32-4-3669326

E-mail: [Robert.Charlier@ulg.ac.be](mailto:Robert.Charlier@ulg.ac.be)

"International Symposium on "The last natural disasters - New challenges for the Engineering Geology and the Geotechnics" is going to be organized by the Bulgarian national Group of IAEG.

**Contact:** Ass.Prof Kiril Anguelov, 11 Prof. G. Zlatarski Str. Vitosha Residential Estate, Sofia 1126, Bulgaria.

Tel:+359-88-555812

Fax:+359-2-685437

E-mail: [geolobby@mail.bg](mailto:geolobby@mail.bg)

## CONGRATULATIONS



N.R. Sthapit

Nepal Geological Society extends hearty congratulation to Mr. Nanda Ram Sthapit, Life Member of Nepal Geological Society and Director General of Department of Mines and Geology, who was decorated with **Suprabal Gorkha Daxin Bahu (3rd)** by His Majesty the King Gyanendra Bir Bikram Saha Dev for his achievements in 2002.



B.D. Shrestha

Nepal Geological Society extends hearty congratulation to Mr. Bishnu Das Shrestha Life Member of Nepal Geological Society, who was decorated with **Prabal Gorkha Daxin Bahu (4th)** by His Majesty the King Gyanendra Bir Bikram Saha Dev for his achievements in 2002.



B.M. Jnawali

Nepal Geological Society extends hearty congratulation to Mr. Bharat Mani Jnawali, member of Nepal Geological Society, who was decorated with **Prabal Gorkha Daxin Bahu (4th)** by His Majesty the King Gyanendra Bir Bikram Shah Dev for his achievements and contribution in Geoscience in 2003.



B.N. Upreti

Nepal Geological Society extends hearty congratulation to Prof. Dr. Bishal Nath Upreti, Life Member and Former President of Nepal Geological Society, who has been appointed as an Academecian of **Royal Nepal Academy of Science and Technology (RONAST)**, Nepal.



L.P. Poudel

Nepal Geological Society also extend herty congratulation to Dr. Lalu Prasad Poudel, Life Member of the society who was awarded **His Royal Highness the Crown Prince Science and Technology Award** by Royal Nepal Academy of Science and Technology for his research on the origin and development of Metamorphic rocks in the Nepal Himalaya.



जितेन्द्र घिमिरे

यस नेपाल भौगर्भिक समाजका आजीवन सदस्य श्री जितेन्द्र घिमिरे श्री ५ को सरकार, जलश्रोत मन्त्रालय, सिंचाई विभागको महानिर्देशक पदमा हालै पदोन्नति हुनु भएकोमा हार्दिक बधाई ज्ञापन गर्दछौं ।

नेपाल भौगर्भिक समाज परिवार

## RECENT PUBLICATIONS

Nepal Geological Society is regularly publishing its Journal of Nepal Geological Society and News Bulletin. So far the society has already published more than 30 volumes (Regular volumes and Special Issues) of the Journals and 20 volumes of News Bulletins. Recently it has published the proceedings of Third Nepal Geological Congress as Journal of Nepal Geological Society, Volume-27 (Special Issue) and Journal of NGS vol.26 and ready for sale. The proceedings includes 19 scientific / research papers on various fields of Geoscience.

### BOOKS

1. Tectonics of the Naga Parbat Syntax and the Western Himalaya, edited by M.A. Khan and P.J. Treloar, M.P. Searle and M.Q. Jan, Geological Society Special publication no.170, 492 pages hardback ISBN 1-86239-061-4. Published in march 2000. Price US\$150.00.
2. Application of Geographic Information System (GIS) for Integrated Assessment and management of Mineral Resources in North East Asia. Mineral Resources Assessment Development and Management Series Volume-7, published by UN/ ESCAP in 2001.
3. Structural Geology: A practical guide to surface and subsurface map interpretation (TextBook) by R.H. Groshong. Springer, 1999, 320pp. ISBN 3540654224, Price DEM 129/-.
4. Analytical solutions of Geohydrological Problems by G. A. Bruggeman, Elsevier, 1999, 970pp, ISBN0444818294. Price US\$465/-
5. Cambridge guides to minerals, rocks and fossils, by A. Woolley et al. Cambridge University Press, 1999, 336pp. ISBN 0521778816, Price US\$14.95.
6. Earth Science and Environment (2<sup>nd</sup> edition) by Graham R. Thompson. Saunders College Publishing 1999. ISBN 0030060486 US\$.
7. Earthquake Geotechnical Engineering (Proceedings of the 2<sup>nd</sup> International Conference, Lisbon, Portugal, 21-25 June 1999, 3 Vols.) by P. Secoe Pinto. A.A. Balkema, 1100pp. ISBN9058091163 Price US\$215/-
8. Environmental Assessment Practice Guide by Barbara Carol and Trevor Turpin. Thomas Telford Ltd. 1999. 150pp. ISBN 0727727818. Price UKL20/-
9. Flood and Landslide: Integrated Risk Assessment (Environmental Science), edited by R. Casale & C. Margottini. Springer, 1999, 450pp hardback UKL96/- ISBN 3540649816 Price DEM249/-
10. Geostatistics in Petroleum Geology by Oliver Du Burle, Continuing Education Course Notes #38. Cat. #908. The American Association of Petroleum Geologists. 1998. ISBN0891811877. Member Price US\$24/- List price US\$30/-
11. Geostatistics for Engineers and Earth Scientists by R.A. Olea. Kluwer 1999. 328pp. ISBN0792385233 Price NGL280/-
12. Geostatistics for Environmental Scientists by R. Webster & M.A. Oliver. John Wiley, 1999. 442pp. ISBN0471965537 Price US\$76.50.
13. Geotechnical Engineering: Principles & Practices, by Donald P. Coduto. Prentice Hall 1999, 750pp, hardback. ISBN013576380. Price US\$110/-
14. Groundwater pollution control, edited by K.I. Katsifarakis. WIT Press, 1999. apx 350pp. ISBN 1853126756. Price UKL112/-
15. Hydrogeology and Engineering Geology of Sinkholes and Karst. (proceedings of the 7<sup>th</sup> Multidisciplinary Conference on Harrisburg Hershey, PA, USA, 10-14 April 1999) Edited by Barry F. Beck et al. A.A. Balkema, 1999, 480pp hard back, ISBN 9058090469. Price US\$115/-
16. On the determination of sediment accumulation rates (Georesearch Forum Vol5) Edited by P. Bruns & H.C. Hass. Trans Tech Publications Ltd. 1999, 256pp. ISBN 0878498370 Price UKL58/-
17. Slope Stability by Anderson. John Wiley 1999. ISBN084934106x Price DEM 108/-
18. Soil Mechanics and Geotechnical Engineering (Proceedings of 11<sup>th</sup> Asian Regional Conference, Seoul, Korea, 16-18 Aug. 1999) edited by Sung-Wan Hong. A.A. Balkema 1999, Two vols. 900pp. Price US\$85/-
19. Soil Mechanics and Geotechnical Engineering (Proceedings of 12<sup>th</sup> African Regional Conference, Durban, 25-27 Oct 1999). Edited by Peter Day. A.A. Balkema, 1999, 3 vol. 1200pp. ISBN9058090825. Price US\$152/-
20. Mineralogy Tutorials: Interactive instruction on CD-Rom Version 2.0 by C.K. Lein. John Wiley 1998 Price



US\$49.95.

21. Dynamic Himalaya: By Prof. K. S. Vaidya, published by University press (India) Ltd. Hyderabad, Distributed by Orint Longman Limited Calcutta, New Delhi, Patna, Lucknow, Mumbai (Bombay).
22. Guide to Scientific and Technical Writing: By Prof. P.G. Cooray. 426 Mahakanda Road, Hindagala, Sri Lanka. Tel (08) 88541). Price US\$5.00.
23. Geological Field Notes and Sketches: By Prof. P.G. Cooray. 426 Mahakanda Road, Hindagala, Sri Lanka Tel (08) 88541). Price US\$5.00.
24. Critical Aspects of the Plate Tectonics Theory Vol. I: Criticism on the Plate Tectonics Theory: Edited by Prof. V. Belousov, 1990, 435 pages Price US\$50.00. ISBN 960-7457-02-1.
25. Theophrastus' Contribution to Advanced Studies in Geology Volume II: Edited by Prof. S.S. Augustithis et al, 1998, 281 pages, ISBN 960-7457-12-9. Price US\$45 (post free).
26. Atlas of granitization Textures and Processes: By S.S. Augustithis, 1993. 500 pages, ISBN 960-7457-08-0. Price US\$75. (Post free).
27. Magma – Crust Interactions and evolution (Geochemical and Geophysical Aspects of the Interactions and Evolution of Magmas and Rocks of the Crust): Edited by prof. B. Bonin et al 1989, 362 Pages, Price US\$38.00 (post free).
28. Atlas of the Textural Patterns of Metamorphosed (Transformed and deformed) Rocks and Their Genetic Significance: By S.S. Augustithis 1985, 401 pages Price US\$65.00 post free).
29. Practical Applications of Trace Elements and Isotopes to Environmental Biogeochemistry and Mineral Resources Evaluation. Edited by Prof. R. W. Hurst et al. 1987, 254 pages. Price US\$30.00 (Post free).
30. A Global Geology by P.W. Harben and M. Kuzvart, 1997 Price US\$198
31. Biodiversity in the Eastern Himalayas: Conservation through dialogue (2002) Edt. By Chen Guangwei. ICIMOD Publication.
32. Water and Erosion studies of PARDYP Nepal: Data of the Yarsha Khola watershed (ICIMOD publication, 2002)

## JOURNALS

Journal of Nepal Geological Society Vol. 28 is in the process of publication.

Journal of Nepal Geological Society volume 27 (Special Issue). Proceedings of 3<sup>rd</sup> Nepal Geological Congress held on 26-28 September 2001 in Kathmandu, Nepal published in May 2003 (in circulation).

Journal of Nepal Geological Society volume 26, published in June 2002 (in circulation).

Journal of Nepal Geological Society volume 25, December 2001 (in circulation)

## PROCEEDINGS

Proceedings of 3<sup>rd</sup> Nepal Geological Congress (Journal of Nepal Geological Society Vol. 27, May 2003) held on 26-28 September 2001, Kathmandu, Nepal

Proceedings of 4<sup>th</sup> SOUTH ASIA GEOLOGICAL CONGRESS (GEOSAS IV), held in New Delhi, India on 13 – 16 October November 2002.

## AWARENESS ABOUT DISASTERS

Following awareness booklets and reports are available in the Library of NGS for consultation.

\*Bhuichalo Bata Kasari Jogine (in Nepali). Published by NGS, 1996.

\*Earthquake Scenario of Kathmandu, Valley. Published by NSET-Nepal, 1998.

\*Comprehensive data Base (Basic Information) on Natural Disaster Management Capabilities in Nepal.

Report prepared by K.P. Kaphle and M. Nakarmi/ NGS for UNDP/DMS, Kathmandu, Nepal, 1997.

\*Badhi Pahiro Binas Bata Kasari Jogine (in Nepali). Published by Luthran World Federation, Kathmandu, Nepal, 2055BS.

\*Aaglagiko Binas Bata Roktham, Purba Tayari tatha Niyantranka Upayaharu 2054. published by Luthran World Federation, Kathmandu, Nepal, 2054BS.

**\*26 Things that help you to survive in an Earthquake  
(by LWF)**

*(a) During an Earthquake:*

1. Stay Calm
2. **Inside** : Stand in a door way, or crouch under a desk or Table, away from Windows or glass dividers.
3. **Outside**: Stand away from buildings, trees, telephone and electric lines.
4. **On the Road**: Drive away from underpasses/ overpasses; stop in safe area; Stay in vehicle.

*(b) After an Earthquake:*

1. Check for injuries and try your best to provide first aid
2. Check for safety for gas, water, sewage breaks; check for downed electric lines and shorts; turn off appropriate utilities; check for building damage and potential safety problems during after shocks such as cracks around chimney and foundation.
3. Clean up dangerous spills
4. Wear shoes
5. Turn on radio and listen for instructions from public safety agencies.
6. Do not use the telephone except for emergency use.

*(c) 13 Survival items to keep on Hand:*

1. Portable radio with extra batteries.
2. Flashlight with extra batteries.
3. Fire Aid Kit-including specific medicines needed for members of your household.
4. First Aid book.
5. Fire extinguisher.
6. Adjustable wrench for turning of gas and water.
7. Portable fire escape ladder for homes/ apartments with multiple floors.
8. Bottled water- sufficient for the number of members in your household.
9. Canned and dried foods sufficient for a week for each member of your household.
10. Non-electric Can opener.
11. Portable stove such as butane or charcoal.
12. Matches.
13. Telephone numbers of police, fire and doctor.

*(d) Things you need to know:*

1. How to run off gas, water and electricity
2. First Aid.
3. Plan for reuniting your family

*(Source: Lutheran World Federation, Nepal- Disaster Preparedness Project, Kathmandu)*

## ANNOUNCEMENT

We are pleased to announce that the Nepal Geological Society is going to organize 4<sup>th</sup> in its series a 3-day 4<sup>th</sup> Nepal Geological Congress on 7 to 9<sup>th</sup> April 2004 in Kathmandu, Nepal. All our members are requested for their kind co-operation and necessary helps to make the congress a grand success. All the interested persons are also requested to contact Dr. Ramesh Man Tuladhar, Convener of the Congress and Mr. Rajendra Prasad Khanal, General Secretary NGS for necessary information. First Circular regarding the Congress has been already distributed . Please note our contact numbers:

Telephone numbers: 977-1-411396

E-mail:ngs@wlink.com.np / nepgeosoc@wlink.com.np





## International Strategy For Disaster Reduction Day For Safety Of Human Lives

By Rajendra P. Khanal

THE United Nations General Assembly defined a decade from 1990 to 1999 as the International Decade for Natural Disaster Reduction (IDNDR) in 1987 and adopted a resolution to drastically reduce damage from natural disasters. IDNDR started in 1990 as one of the major activities of the United Nations. The second Wednesday of the October was declared the IDNDR Day.

### Cooperation

The IDNDR Day has been observed in Nepal since 1991 by organising meetings, seminars and training programmes. These programmes often receive a national focus and many governmental and non-governmental organisations have been involved.

The Nepal Geological Society (NGS) had, over the years been working in close cooperation with the IDNDR National Committee, Ministry of Home Affairs, UNDP/Nepal and Lutheran World Service Nepal in fulfilling the goals of IDNDR.

Nepal is a disaster prone country in the world. Because of her location characterised by rugged topography, very steep slope, variable climatic conditions, complex geological structures with active tectonic process and continued seismic activities, the country is prone to various types of natural hazards. These vary from snow avalanches and glacier lake outburst to flood (GLOF) in the higher Himalayas to fire and flood in the rest of the country. Landslides and earthquakes are frequent. They are causing extensive damage to the national economy and incurring heavy loss of lives and property every year. So many government and non-government organisations are involved in the disaster reduction and mitigation works in Nepal.

The concept of IDNDR has been

instrumental in transferring the emphasis from relief and rescue to preparedness. Various agencies of His Majesty's Government of Nepal like Ministry of Home Affairs, Department of Narcotics Control and Disaster Management, Department of Water Induced Disaster Prevention, Department of Soil Conservation etc. are active in disaster prevention, mitigation and management works in close cooperation with various international agencies such as United Nations Development Programme (UNDP), Japan International Cooperation Agency (JICA), Asian Disaster Reduction Centre (ADRC), Asian Disaster Preparedness Centre (ADPC), International Centre for Integrated Mountain Development (ICIMOD), International Red Cross Society (IRCS), United Mission to Nepal (UMN), Cooperation for American Relief Everywhere (CARE), World Food Programme (WFP), Save the Children Fund (SCF), Technical Cooperation of the Federal Republic of Germany (GTZ), Lutheran World Service (LWS), OXFAM etc. Besides these, various other professional and non-governmental organisations like Nepal Geological Society, Nepal Red Cross Society, Nepal Engineers' Association and NSET Nepal have also been providing highly valuable support to the natural disaster mitigation and management works in Nepal.

Based on the lessons from the International Decade for Natural Disaster Reduction (IDNDR), the UN has established the International Strategy for Disaster Reduction (ISDR) as a global framework for action with a view to enabling all Societies to become resilient to the effects of natural hazards and related technological and environmental disasters in order to reduce human, economic and social losses. It involves a conceptual shift from an emphasis on disaster response to the management of risk through the integration of disaster

reduction into sustainable development.

The implementation of the Strategy is premised at the establishment of partnerships between governments, non-government organisations, UN agencies, the scientific community, the media as well as other relevant stakeholders in the disaster reduction community.

The four goals of the strategy are to increase public awareness about disaster reduction to obtain commitment from public authorities to stimulate inter-disciplinary and inter-sectoral partnerships, and to improve the scientific knowledge of the causes of natural disasters and the consequences of the impact of natural hazards.

National Participation, as the primary ingredient for sub-regional, regional and international cooperation with regard to natural disaster reduction is a critical factor of the success of the ISDR. 'ISDR National Committee' or 'ISDR Focal Point' is designated by the government of each country and serve as an interface between national and international levels within ISDR. In any event the national platform should be kept informed and copied on all relevant correspondence between the Secretariat and contacts at national level.

### Involvement

ISDR Day has been proposed by the UN for second Wednesday of October of every year from 2001. The Nepal Geological Society observed ISDR Day by conducting a seminar on natural disaster reduction in cooperation with Ministry of Home Affairs and UNDP/Nepal. All concerned authorities of HMG of Nepal, all relevant consulting firms, NGOs and INGOs and professional organisations as well as local political activists of all municipalities of Kathmandu Valley are actively involved in the seminar.

Kathmandu • Thursday, October 10, 2002

The Rising Nepal

# Over 440 dead in aftermath of rains

By Rameshwar Yadav

KATHMANDU, Oct 9: More than 440 people lost their lives and 55,737 families were affected along with a huge amount of property destroyed or damaged by the rains and floods in the country this year, Secretary at the Ministry of Home Affairs Tika Dutt Niraula said.

Speaking at a seminar 'Disaster Reduction for Sustainable Mountain Development', organised on the occasion of International Strategy for Disaster Reduction Day 2002, the country has been facing problems in rescue and mitigation of disasters due to difficult geographical structure, inadequate communication facilities, technological gap, institutional weakness and lack of co-ordination among the organisations working for disaster management.

"We cannot utterly prevent the natural calamities but creating the awareness among the public about

the disaster and its possible way of the mitigation of it," he said.

The seminar was organised by Nepal Geological Society (NGS) in collaboration with Ministry of Home Affairs and other related departments.

Chief guest and member of the National Planning Commission (NPC) Dr. Jagdish Chandra Pokharel said that natural disasters such as floods, landslides, earthquakes, fire and epidemics are common phenomenon causing considerable loss of life and property in the country every year.

"Among the natural calamities, floods and landslides cannot be prevented because of scarcity of resources and funds," he said, adding that scientists, people working in this field, and the civil society should work together to reduce the effect of natural disaster.

He claimed that scientists in Nepal often remain

passive, and they do not play their role as they should have to prevent it. "Nepal lies in a sensitive zone, and natural disaster of unpredictable dimension could happen here."

Coordinator of NGS-ISDR Council Ramesh Kumar Aryal said that they should learn from the traditional wisdom of the people living in the mountains to cope up with natural disasters and other hazards in the mountains.

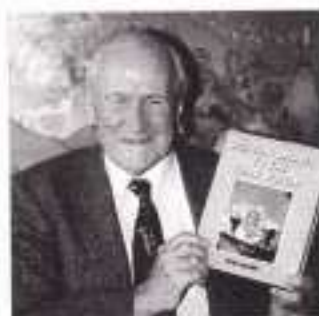
He said that because of the complex geological and fragile structure of soil, the country has been witnessing huge losses of life and property caused by earthquakes, floods, landslides, soil erosion, and the glacial lake outburst flood (GLOF).

President of NGS Pratap Singh Tam, Director General of Department of Mines and Geology, N.R. Shrestha and general secretary of NGS Rajendra Prasad Khanal also spoke on the occasion.



## OBITUARY

### Late Dr. Toni Hagen



17 August 1917-April 2003

Place of Birth:

Lusarn, Switzerland

Education:

M.Sc and Ph.D (Geology)

Profession:

Geologist/ Geomorphologist

Award:

Birendra Pragyalkar from Royal Nepal academy

Distinguished Person of Kathmandu from Kathmandu Metropolitan Municipality

First visit to Nepal:

1950

Recognized as an specialist in Nepal

Publications:

- (1) Kingdom of Nepal
- (2) The Memory of Nepal (1950 – 1992)
- (3) Documentary film about Nepal.  
Nepal with lots of beautiful photographs showing natural beauty of Nepal Himalaya.





Place of Birth:

Bhojpur Nepal

28 December 1951–9 July 2003

Education:

M.Sc. (Physics)

Ph.D. (Geophysics) from Roorkee University, India (1990)

Office:

Central Department of Physics, Tribhuvan University, Kathmandu, Nepal

Professional Experience:

Teaching and Research since 1977.

## Reducing Earthquake Risk means:

1. Improving emergency response planning and capability.
2. Improving awareness of issues relating to earthquake risk.
3. Integrating seismic resistance into the process of new construction.
4. Improving the earthquake safety of school children and school buildings
5. Improving the seismic performance of existing buildings.
6. Improving the seismic performance of utility and transportation systems.
7. Increasing experts' knowledge of the earthquake phenomenon, vulnerability, consequences and mitigation techniques.
8. Preparing for long-term community recovery following damaging earthquakes.

*NSET aims to assist all communities in Nepal to become safer against earthquake by 2020 AD by developing and implementing organized approaches to managing earthquake risk.*

We understand that this challenge can be achieved only through partnership between communities and institutions.

**For further details, please contact:**



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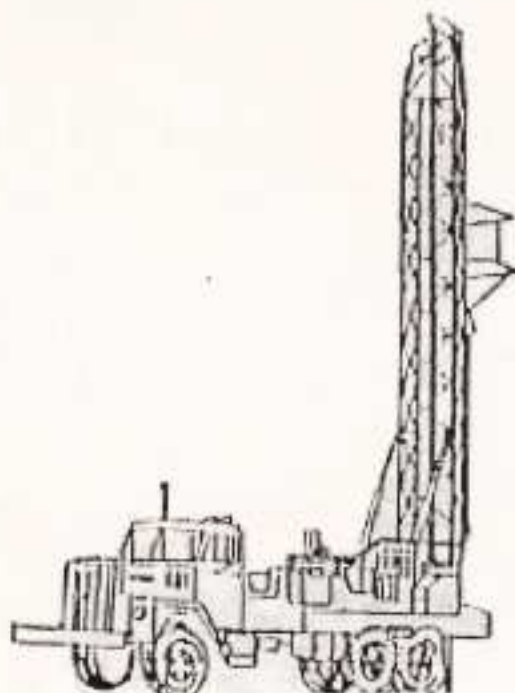
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